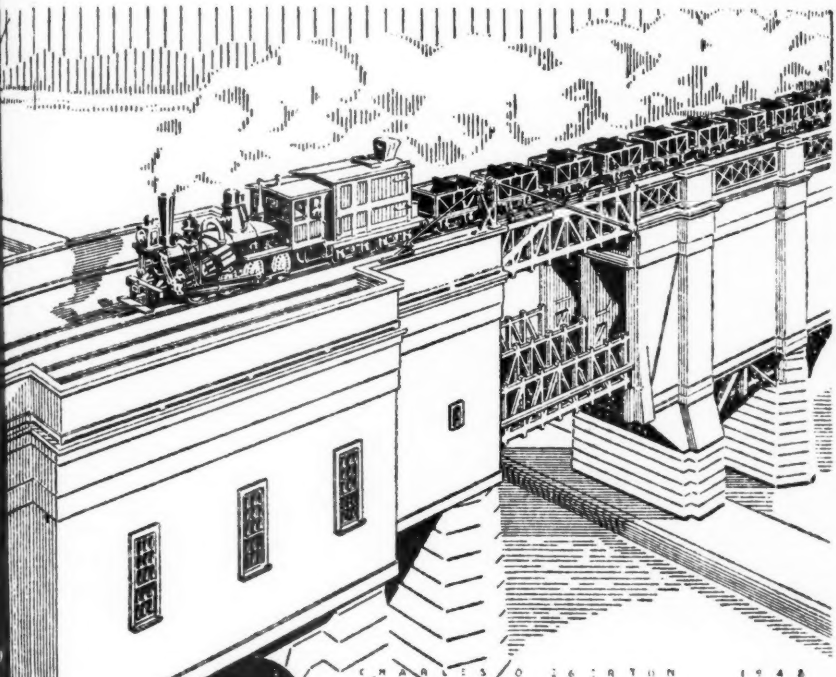
The Railway and Locomotive Historical Society

BULLETIN No. 89



THE RAILWAY AND LOCOMOTIVE HISTORICAL SOCIETY

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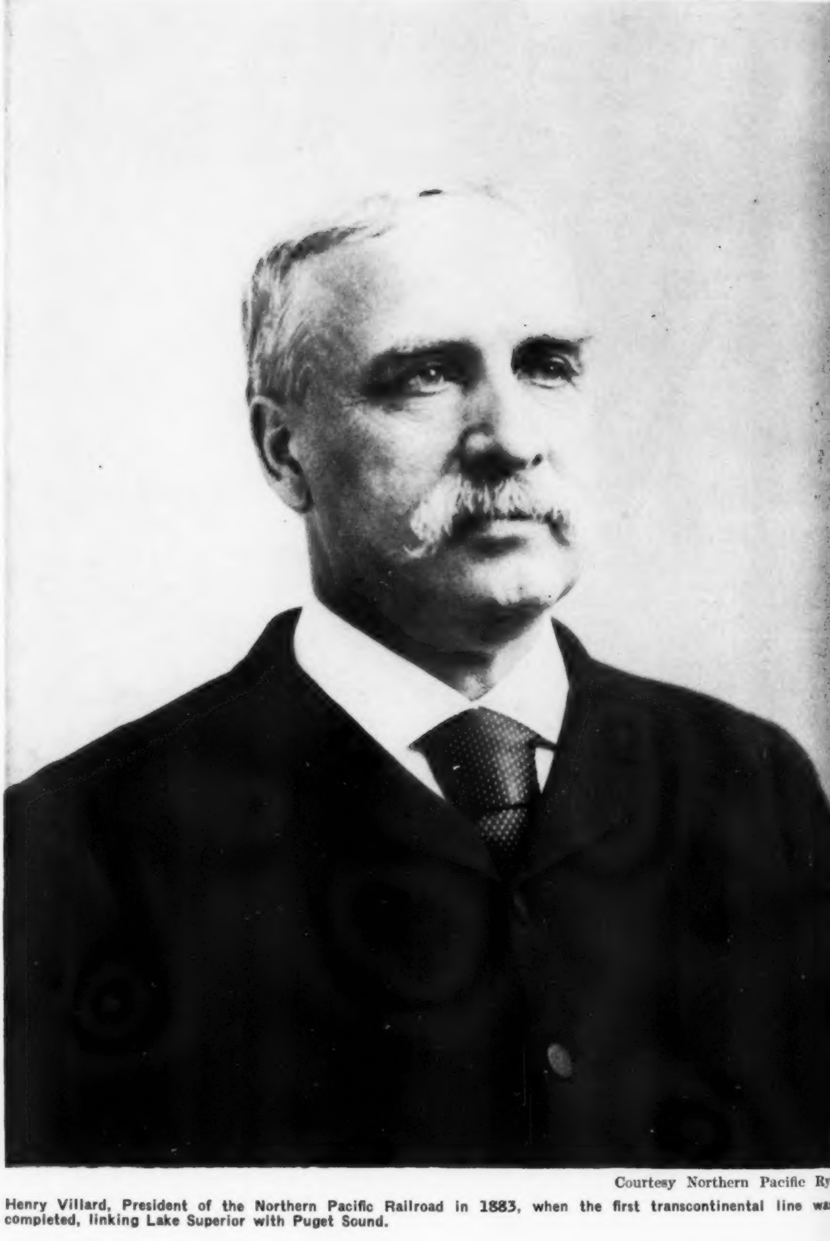


Courtesy Northern Pacific Ry.

Henry Villard, President of the Northern Pacific Railroad in 1883, when the first transcontinental line was completed, linking Lake Superior with Puget Sound.

The Railway and Locomotive Historical Society, INC.

To those who took the trouble to write expressing their appreciation of the colored frontis-piece and the beautiful drawings the author furnished with his article on valve motions, we wish to express our thanks. To those who did not find a particular valve motion in the first article, we ask them to be patient—there are many more to follow. Letters are always welcome relative to our bulletin and, in this connection, let me state that the success of our publication depends a great deal upon the interest shown by our membership. Only from them are contributions considered and if any of you feel inclined to prepare material along such lines as can be used, your editors will gladly consider it.

In this publication we are including another chapter on valve gears by Fred Jukes and your editor has written the first of three chapters covering the steam locomotives of the Pennsylvania R. R. Certain classes of the locomotives of this road have been covered in some of our previous bulletins by the late Charles B. Chaney but we have never published an article or a series of articles covering them as a whole.

We welcome to our columns Robert Garasha and his contribution on that interesting logging railroad in Michigan—the Mason & Oceana R. R. and we also hope that our members will find the biography of Henry Villard, identified with our railroads of the northwest of interest. Mr. Donovan, the author, is well known with us for his publication—The Railroad in Literature and many of us recognize his ability in writing railroad history with his work on the Minneapolis & St. Louis Ry.

The diary of Horatio Allen is published, not because it relates to his ordering the first four locomotives for the Delaware & Hudson

Co.; another book, which has failed to appear evidently contains this information but, this diary does present some interesting contrasts in that it shows England, at the birth of the railway and how it impressed an American, one who had never seen a railway or a locomotive in operation. Certainly, it would seem as though these people went out of their way in their hospitality to do everything possible for Allen and for those that followed in the years to come.

One member took the trouble to assist Mr. Brown in his quest for data as noted in Bulletin 88. Our trail narrows but we would like information on two engines on each of the following railroads: Alexandria & Cheneyville; Alabama, Florida & Georgia and Sugar Loaf Railroads and one each on the Lake Wimico & St. Joseph; Philadelphia & Trenton and Little Schuylkill Railroads. This is a long time ago, over 100 years, but Mr. Brown will welcome any assistance in the matter.

Lastly, Mr. Saunders has worked up a brief account, together with a locomotive roster of the Pittsburgh, Chartiers & Yioghiogheny R. R. which he hopes our members will appreciate and find of interest and value.

Cover Design

Some time ago, our member Charles O. Egerton, submitted a cover design of a Camden & Amboy "Monster" locomotive, and this publication seems a fitting place to use it.

The date of construction of the first of these locomotives is still uncertain but, it would seem as tho' they were the first 0-8-0 locomotives built in this country and antedate Winan's "Maryland" by several years.

The artist has depicted one of these locomotives during an intermediate period in the 1840's during which time a cab, headlight, bell, footboard and tender have been added. The scene shows one of the locomotives, westbound crossing the draw bridge over the Delaware and Raritan Canal at New Brunswick, followed by a "string" of six ton, four wheel coal "Jimmies." The bridge was built in 1838 and destroyed by fire in 1878.

It was doubtless the intention of the designer to minimize the rod angularity and at the same time, keep the wheel base as short as possible. What that thirteen foot main rod, working on a 30" stroke and 48" drivers could do in the way of dynamic augment is rather alarming. I doubt if they ever dared to run them faster than fifteen miles an hour.

We wish to thank Mr. Egerton for his sketch and his comments and we hope our members will enjoy it.

Steel Rails

This new little weekly magazine is published by one of our members —James C. McKeekin, 116 West 16th Street, Davenport, Iowa. The magazine is still in its infancy so that it is hardly fair to either criticise or compare. It is printed on good calendared paper, the cuts are good and clear and the type is easy to read. The articles are varied and of

general interest. On the last page is a section devoted to a "Railfan Calendar" and here will be found notices of the activities of the various chapters of the different societies. These notices are inserted without charge and a cordial invitation is extended to the chapters of this society to use this medium of information.

We certainly wish Mr. McMeekin success in his efforts. The writer is still of the opinion that the two monthly "fan" magazines published in this country have considerable room for improvement. It is certainly unfortunate that this vast country, with its great net-work of railroad mileage and with the possibility of a huge roster of readers, can't produce a magazine that our libraries will consider worth giving shelf room.

The subscription price to "Steel Rails" is $4.00 per annum and we wish Mr. McMeekin success in his efforts.

Southern California Chapter

Upon receipt of a petition signed by the required number of members in good standing, on July 20th last, Mr. Forsyth, our Secretary, authorized the formation of this chapter, whose activities will be in Los Angeles and the contiguous area. Their first election resulted in the following officers: Walter H. Thrall, Chairman; Alvin A. Fickewirth, Vice Chairman and Donald Duke, Secretary-Treasurer.

The need of a chapter in this area has long been felt, particularly in view of the splendid work being done by the fellow members in the San Francisco Bay area through the Pacific Coast Chapter. Many of our members have wished to engage in these activities but, they have been acutely aware of the 500 miles separating them from San Francisco.

With a view of sounding out the membership in the Los Angeles area, post card notices were sent out and the initial meeting was held in the Union Pacific's Mechanical Building assembly hall in the East yards of Los Angeles on the evening of June 19, 1953. Although it was a time of vacations, twenty-seven members attended this meeting and all were enthusiastic for the formation of a chapter. A petition for such a formation was drafted at this meeting and sent to headquarters. Nine directors were elected at this meeting—Messrs. Carl Blaubach, Clifford C. Bong, Norman Clark, Donald Duke, Alvin A. Fickewirth, Kenneth Hackman, Donald Richardson, James E. Hicks and Walter Thrall. These nine directors are divided into three groups, terms of which will expire at annual intervals.

The first board meeting was held at the home of Mr. Donald Duke on July 7th, 1953 and the officers, as previously stated, were elected at this meeting. Mr. Clark was elected temporary Secretary-Treasurer until September at Mr. Duke's request.

For the time being, the meetings will be held in the Union Pacific's Mechanical Building at East Yards, 4340 East Washington Boulevard, East Los Angeles, on the FOURTH Tuesday of each month at 7:30 P. M. This is a two-story building between the CTC building and the locomotive back shops and we have the use of it through the courtesy

of the Union Pacific R. R. A committee is working for a more centralized location and, if successful a further announcement will be made.

The second chapter meeting was held on July 28th and at this meeting it was announced the chapter had an enrollment of thirty-five (35) members. One member gave an excellent talk and display of his collection of locomotive builder's plates with his novel way of displaying them and Donald Duke projected his magnificent color slides of the Rio Grande Southern and D. & R. G. W. narrow gauge views that were enjoyed by all.

Future plans include similar meetings and the matter of interesting excursions has not been overlooked. It's the hope and ambition of these chapter officers and directors that this chapter, like the Pacific Coast Chapter, will become one of the most active in the Society. To do this, it means that as many as possible must participate in its affairs and if all will work together there is no limit to its possibilities. A cordial welcome awaits any member on the FOURTH Tuesday of each month and we hope that many of our members will accept this invitation and we wish our newest chapter success in their efforts.

Courtesy Minnesota Historical Society

The famous "Villard Arch" in St. Paul erected in 1883 for the Villard celebration to welcome his party on the way west to celebrate driving the "last spike" at Gold Creek, Montana, September 8, 1883.

Henry Villard

Colonizer of the Pacific Northwest, Builder of the First Northern "Transcontinental," Exponent of Inter-Railroad Harmony

By Frank P. Donovan, Jr.

When the bark *Nordamerica* arrived in New York in October, 1853, it brought an eighteen-year old immigrant from Hamburg, Germany. The lad could not speak a word of English, he had no friends in the eastern states and, with the exception of twenty dollars loaned to him by a companion on the boat, he was without funds. The young German, however, had a driving ambition, a desire of knowledge, and the ability to accept defeat and start all over again.

Ten years later this alien youth became a brilliant Civil War correspondent. Less than twenty-five years after his arrival in New York he headed an enterprising Oregon railroad and a strategic Pacific Coast steamship line. Backed by German capital, Henry Villard soon dominated transportation into Portland and along the Columbia River. Next he controlled the Northern Pacific Railroad and, under his presidency, completed it in conjunction with the Oregon Railway & Navigation Company from St. Paul to Portland. Meanwhile he became wealthy. But the depression of 1884 saw his fortune evaporate and the presidency of the NP go to other hands. Henry Villard was down but not out. With high courage he started anew, becoming again head of a large Oregon holding company and board chairman of the Northern Pacific. Always on the alert as a reporter for a good story, his greatest feature was, perhaps, not what he wrote *about* but what he himself *did*. Indeed, his life was an epic filled with action, adventure, crushing defeat and towering success.

Born in Speyer, Rhenish Bavaria, April 10, 1835, Henry Villard's original name was Ferdinand Heinrich Gustav Hilgard. His sympathy for the revolution of 1849 in his native land alienated his father's affections. Further discord after attending the universities of Munich and Würzburg led him to break away from paternal ties and come to America. At the same time he changed his name to Henry Villard.

Lacking funds and finding employment difficult, young Henry made his way from New York to the Midwest by immigrant trains and second-class boat passage. Arriving in Indiana, he hired out as a crewman on a wood-train of the Indianapolis & Madison Railroad, now the Pennsylvania. An attack of intermittent fever cut short his brief rail employment. Little did he realize at the time the role railroads would play in his later life.

After much hardship he arrived at the home of relatives in Belleville, Illinois, where he stayed for the winter. During the next few years he served as a clerk for the Recorder of Deeds at Carlyle, read law in Peoria, peddled books in Milwaukee, Wisconsin, sold real estate in Chicago, and embarked upon an abortive attempt to form a free-

soil German colony in Kansas. All the while he learned to master the English language with the ultimate objective of either taking up a literary career or becoming a newspaperman. Favorable comment from letters he had written for the Belleville *Zeitung* encouraged him to go into journalism. When offered the editorship of the Racine (Wis.) *Volksblatt* he avidly accepted. The paper, formerly a Democratic organ, had espoused the Republican cause in which Villard was very much in sympathy. With the Democratic landslide of 1856, however, the weekly lost most of its subscribers, and Villard was obliged to turn the paper back to its former owner and quit.

Still determined to pursue journalism, he went to New York and made the acquaintance of Charles A. Dana, then editorial manager of the *Tribune*, and the editors of the *Times* and *Herald*. Although these contacts later proved of value, he came away without a job. Turning to papers in his own tongue, he succeeded in getting articles in the *Staats-Zeitung*, *Neue Zeit* and the German edition of *Frank Leslie's Illustrated Weekly*.

The dogged persistency which was very much a part of his makeup, combined with a nose for news, led him again to wait upon Dana. This time he had a concrete proposition to offer. It was to cover the hectic constitutional convention in St. Paul, Territory of Minnesota. Dana agreed to pay Villard on a space basis to report the convention. Lack of funds for travel expenses, however, appeared to be an insuperable obstacle until a fellow reporter suggested he see the famous Thurlow Weed, editor of the Albany *Journal*, and try and wrangle a pass. He did so and obtained transportation to the western rail-head at Prairie du Chien, Wisconsin. From that river community he went up the Mississippi to St. Paul. The differences in framing the state constitution were soon settled, however, and Villard was out of work. He, nevertheless, spent some time touring Minnesota, and his knowledge of the country later proved of value when he headed the Northern Pacific.

The Panic of 1857 made it difficult to get newspaper jobs, so the young man taught school in Jonestown, Pennsylvania, for a livelihood. In 1858 he gave up teaching to canvass subscriptions for the *Staats-Zeitung* in the Midwest. Sensing the news appeal of the Lincoln-Douglas debates, he subsequently reported them for that paper. For another decade Henry Villard remained in journalism.

The training and techniques Villard acquired as a newspaperman carried over into his railroad work; hence a brief account of his later journalistic endeavors is in order. In 1859 he went with the Cincinnati *Daily Commercial* and was soon assigned to report on the "gold news" in the vicinity of Pike's Peak and along the headwaters of the Platte River. His subsequent trip to the Rocky Mountains led him to publish a guidebook called *The Past and Present of the Pike's Peak Gold Regions.* This firsthand knowledge of the area was one of the factors which led to his being made a receiver for the Kansas Pacific Railway almost two decades later.

Returning to the Midwest, he reported the Chicago National Republican Convention in 1860 for the *Commercial* and the ensuing campaign for that paper, the St. Louis *Daily Missouri Democrat* and the New York *Tribune*. Villard's outstanding work as a reporter, however, came to the fore with the outbreak of the Civil War. As a war correspondent sympathizing with the Union Cause, he was employed by the New York *Herald* and later the New York *Tribune*. He covered many of the battles, including the first Bull Run, the Federal half-victory at Shiloh, the battle of Perryville and the defeat of Fredericksburg. He was the sole correspondent on the *New Ironsides* during the ill-fated attack on Fort Sumter. Serious illness in the summer of 1863 kept him from witnessing the battles at Chickamauga and Chattanooga.

After recuperating in Washington, D. C., he represented the Chicago *Tribune* in the Capital and organized a news agency to compete with the Associated Press. He reported the drawn battles in the Wilderness for the agency and witnessed the siege of Petersburg in 1864. After the war he served as an American and European correspondent until appointed secretary of the American Social Science Association in 1868. While with the Association in Boston he furthered civil service reforms and investigated public and corporate finance, including that of railroads and banks. This served as a prelude to his spectacular career as a railway promoter and financier.

Henry Villard's entry into railroading came about by chance. While he was in Germany recuperating from illness, an acquaintance of his asked for advice regarding Oregon & California Railroad bonds. Villard, knowing little about Oregon and nothing about the railroad, referred him to a bondholders' protective committee at Frankfort. After reviewing the data obtained from the committee, Villard gave an unfavorable opinion on the investment. This led to the chairman of the committee visiting him and a subsequent invitation to join the body, which he accepted. In 1874, at the request of the committee, Villard came to America to effect an agreement with Ben Holladay, president and chief stockholder of the Oregon & California.

Villard was not at all impressed with Holladay's management, but he was much pleased with the climate and resources of Oregon. He advocated establishing an immigration bureau to help colonize the state and made an agreement with Holladay vesting more control in the hands of the bondholders. He returned to Germany only to find the agreement had not been kept. Villard then took the bit in his hands and with the backing of the bondholders bought out Holladay's interest in the Oregon & California and the Oregon Central railroads, both of which extended along the Willamette Valley, south of Portland. The deal also included the Oregon Steamship Company, operating between Portland and San Francisco. In 1876 Villard was elected president of the O&C and the steamship line.

Villard's talents, however, were not limited to railroad promotion in the Northwest, for late in 1876 he was made a receiver of the Kansas Pacific Railway. In that undertaking he was obliged to cross swords with such powerful figures as Jay Gould and Sidney Dillon, of the Union Pacific. Eventually the Gould crowd acquired the Kansas Pacific for

the UP. But Villard was not outsmarted in the deal, and he saw that satisfactory terms were made with the German bondholders whom he represented.

By this time Villard was lord of his domain in the Northwest. Well, not quite, for the Oregon Steam Navigation Company had a monopoly on the important Columbia River. Villard realized the company was not only valuable as a boat line but as a concern having railroads around portages. The time was not far distant when a railroad would be constructed along the south bank of the Columbia, and he who dominated the Navigation Company would hold the key to Portland and the Northwest. Villard lost no time in buying the line, and he and his associates formed the Oregon Railway & Navigation Company to build along the south bank of the river.

Meanwhile, the Northern Pacific was revitalized, and commenced building with renewed vigor. The road had its eye on a projected line over the Cascades to Puget Sound with a branch along the Columbia to Portland, secondary, if at all. Villard sought in vain to interest the NP in using his route to Portland instead of a trans-Cascade line. Failing in this, he conceived of what was known as the "Blind Pool," an audacious plan to dominate the first northern "transcontinental." Villard issued a confidential circular to about fifty people, asking them to subscribe to a fund of $8,000,000 to lay the foundation for "a certain enterprise," the exact nature of which would not be disclosed before May 15, 1881.

Bold as the plan was, investors had faith in Villard and the utmost respect for his integrity. The very novelty appealed to investors, and the effect of the pool was like magic. "One-third of the persons and firms appealed to signed the full amount asked for before the subscription-paper could reach the other two-thirds," he recounts in his *Memoirs*. "Then a regular rush for the privilege of subscribing ensued, and, within twenty-four hours of the issue of the circular, more than twice the amount offered was applied for." Villard called for an additional $12 million, and that, too, was quickly subscribed. With these funds Villard purchased control of the NP.

In 1881 Henry Villard became president of the Northern Pacific. Meanwhile, he had organized a holding company, the Oregon & Transcontinental, to coordinate his interests in railroad and steamship properties.

Under Villard's aggressive leadership the Northern Pacific was rushed to completion. During his two-year regime as head of the road almost 2,000 miles of new line was constructed. With a newspaperman's flair for publicity Villard made the completion of the "transcontinental" an international affair. Five trainloads of guests on an all-expenses-paid trip made the celebration one of the most lavish events in railroad history. On the way west an elaborate all-day celebration was held in St. Paul.

Coincident with the journey west came the laying of the cornerstone of the Territory of Dakota's capital at Bismarck. The occasion called for a speech by Villard and a few remarks by the Indian, Iron Bull. In eastern Montana a gathering of about 2,000 Crow Indians performed

Courtesy Northern Pacific Ry.

The Villard "Gold Spike Special," one of four special trains which traveled over the Northern Pacific from St. Paul to Portland in 1883 on the occasion of the completion of the Northern Pacific Railway. The last spike was driven at Gold Creek, Montana on September 8, 1883 when lines from east and west met to complete the first of the Northern transcontinental railways. Many notables were present including 10 United States senators, 3 former senators, 26 congressmen, 2 former congressmen, 9 governors, 4 ex-governors, 9 army generals, many leading railroad executives, judges and mayors and a large party of foreign dignitaries. 50 journalists from America's leading newspapers covered the story. Following the ceremonies at Gold Creek, the special train proceeded on to Portland.

Courtesy Northern Pacific Ry.

Photo of mural painting in Montana state Capitol at Helena depicting driving of last spike completing Northern Pacific Railway at Gold Creek, Montana, September 8, 1883. General Grant is shown with spike maul and at his left is shown Henry Villard then President of the Northern Pacific. Note: Actually it was Villard who drove the "last spike," not Grant, as the mural would seem to indicate.

a war dance. The "last spike" was driven by Villard in Hellgate Canyon near Garrison, Montana Territory, on September 8, 1883. Fitting celebrations also welcomed Villard's entourage at Portland, Tacoma and Seattle.

Actually, the spike which Villard drove on that auspicious occasion was not the last nor was it a golden spike, as reported in the papers. The transcontinental line had been completed on August 22, but a gap of 2,737 feet in length was left in the main line with the ends connected by a side track which looped around the gap. And Henry Villard's carefully planned program to record the final tapping of the "last spike" over the telegraph wires throughout the nation went amiss. A telegraphers' strike was in progress, silencing the commercial wires—and the single railroad wire was so taxed with train orders that newspaper copy could not be dispatched. It was an ill omen, auguring a series of untoward events culminating in financial difficulties for the NP and the resignation of Villard.

Many of the overseas guests were so unused to seeing great stretches of barren land that they went back to Germany and England and reported unfavorably on the project. The fact that construction costs were underestimated by several million dollars also contributed to the NP's financial troubles of 1883. On January 4, 1884, Villard's resignation was accepted by the NP's directors. Previous to this he resigned from the presidency of the Oregon Railway & Navigation Company and the Oregon & Transcontinental.

This came as a severe blow to Villard, who never had been in the best of health. He suffered a nervous breakdown and went abroad to recuperate. Improved health and an indominable will, however, brought Villard back to Oregon in significant managerial roles.

In 1887 the Oregon & Transcontinental had difficulty in renewing its loans. Elijah Smith, the holding company's president, turned to its founder, Henry Villard, for aid. By this time Villard was representing the Deutsche Bank in New York and had command of considerable capital. With characteristic energy Villard marketed $5,000,000 in securities within thirty-six hours. Again Villard came back to his Oregon railroads and subsequently was made board member of the Northern Pacific and for a brief time chairman of the board. His return to the NP prompted the Portland *Oregonian* to aver, "His position seems to be one that will enforce fair dealing all around." The Seattle *Post Intelligencer* highlighted the occasion by issuing an extra edition.

Villard's re-entry into the NP in 1888 came about when there was a mad scramble of railroads jockeying for supremacy. The Union Pacific and the Northern Pacific sought to control the Columbia River gateway; the Southern Pacific was controlling railroads along the Willamette River, and the uncompleted Great Northern (then known as the St. Paul, Minneapolis & Manitoba) was pushing westward to Seattle. To make matters worse, James J. Hill, head of the Great Northern, was negotiating with President Charles Francis Adams of the Union Pacific. The UP leased the Oregon Railway & Navigation

Company, and Hill sought to obtain running rights for his trains over the OR&NC from Spokane to Portland. On top of this, the three important north coast cities, Portland, Tacoma and Seattle, were vying ruthlessly with each other for commercial and industrial supremacy.

Villard's new role was that of a peacemaker. True, his immediate problem was to keep the Union Pacific-Great Northern forces from dominating the Oregon & Transcontinental, which in turn controlled the Oregon Railway & Navigation Company. More than this, Villard saw the harm of rampant competition, duplication of facilities, and needless rate wars. He advocated equal rates to and from common points served by rail lines from Portland and Puget Sound points. In short, he stressed building up the Pacific Northwest as a whole and not at the expense of one city or one railroad.

To put his ideas into practice, he brought into being the significant "Joint Lease," in which the NP and UP had equal interests in the Oregon Railway & Navigation Company. The Lease also outlined spheres for branch line construction to eliminate unnecessary duplication. Warring factions, however, broke up the Lease; and an "Arbitration Contract," subsequently made to perform much the same functions of the Lease, fared no better. With the failure of both of these vehicles of arbitration and cordination, unrestricted competition continued. The orgy in competitive branch line construction had much to do with the receiverships of the Northern Pacific and the Union Pacific, both of which came about in 1893. In that year Villard severed all connections with the NP.

In attempting to bring about inter-railroad harmony, Henry Villard was ahead of his time. Looking back, however, it is evident that many of the policies he advocated were put into effect after his death in 1900. For example, the NP's line from Portland to Puget Sound is no longer exclusively used by that road; pooled service is now featured by the Northern Pacific, Union Pacific and Great Northern. Furthermore, when the Spokane, Portland & Seattle was built along the north bank of the Columbia River in 1908, it was ordained from the start that it would be jointly owned by the Northern Pacific and Great Northern. Finally, the 258-mile Camas Prairie Railroad in the rich wheat and timber country of eastern Washington and northern Idaho has been jointly owned by the Northern Pacific and the Union Pacific since 1909. On the other hand, many miles of grass-grown tracks and duplication of branch lines stands as mute evidence to the wasteful competition which Villard abhorred.

As a colonizer, Henry Villard's role is equally significant. He pioneered in opening a railroad land and immigration office in Portland during the mid-seventies. Later immigration offices were established in Boston, Omaha and Topeka; overseas bureaus were opened in England and Scotland. Many booklets were distributed concerning the Northwest, some of which he wrote himself. This immigration work was greatly accelerated when Villard headed the Northern Pacific. At one time, according to J. B. Hedges' ***Henry Villard and the Railways of the***

Northwest, he had 831 agents in the British Isles and 124 on the continent. He subsidized a monthly magazine, *The Northwest,* to publicize the territory served by the Northern Pacific. Under the auspices of the railroad, its editor, Eugene V. Smalley, wrote the first —and, to date, the only—history of the Northern Pacific. Villard shrewdly had it published in 1883, the year the road was completed.

Obviously Villard had his shortcomings, not the least of which was his sheer enthusiasm, which sometimes led to unwise expansion and ill-timed construction. His policy of paying large dividends was not always justified, and the leasing of the Wisconsin Central to form a Chicago link for the NP proved to be a mistake. Incidentally, it was Villard who had the present Grand Central Station built in Chicago to form the eastern terminous of his "transcontinental" trains. Of striking Norman castellated architecture, it originally had a 11,000-pound bell tolling the hours of a clock in its lofty tower. When the Station was completed in 1890 the clock was the second largest in the nation.

Apart from his proficiency as a journalist, railway promoter and financier, Villard was something of an idealist and an humanitarian. He advocated freedom of speech, of thought and of action; a heritage exemplified in his son, the late Oswald Garrison Villard, for many years editor of the *Nation.* His wife, Fanny, the daughter of abolitionist William Lloyd Garrison, whom he married in 1866, was a militant reformer. In the early eighties, when Villard acquired a controlling interest in the New York *Evening Post,* he placed Horace White, Edwin L. Godkin and Carl Schurz in control and abdicated all editorial supervision. He contributed liberally to educational and social work and gave generous assistance to the Oregon and Washington state universities. Villard was interested in the electrical industry and for several years headed the Edison General Electric Company. He launched what is reputed to be the first electrically-lighted sea-going vessel in 1880. It was the *Columbia,* which for many years sailed between Portland and San Francisco.

Journalist, Civil War correspondent, exponent of civil service reform, philanthropist, "generous friend of learning, science and the arts," Henry Villard, however, is best remembered as a promoter of railroads and a pioneer builder of the Pacific Northwest.

Acknowledgments

The author is grateful for the help tendered by Messrs. L. L. Perrin and William P. Jensen, manager and assistant manager, respectively, Advertising and Publicity Department, Northern Pacific Ry. and Miss Lois M. Fawcett, head, reference division, Minnesota Historical Society, St. Paul. Minn.

101 Valve Motions

By Fred Jukes

(Second Installment)

The first installment of this history of locomotive valve gears appeared in Bulletin No. 88, and covered three groups of gears, viz., Early Valve Gears, Hook or Grab Motions, and Link Motions. This section treats of gears of the Hackworth Principle, and covers the following types, in the order named.

Hackworth 1, 1859	Baker 1
Hackworth 2, 1859	Baker 2
Hackworth 3, 1859	Baker 3
Hackworth, 1876	Marshall
Henderson-Hackworth	Strong 1
Hackworth (Netherlands Rys.)	Strong 2
Sentinel-Hackworth	Southern
Bremme	Lentz (Marshall)
Jack 1	Wilson
Jack 2	Brown 1
Joy 1	Brown 2
Joy 2	Brown 3
Joy 3	Brown (Joy)
Joy 4	Joy-Walschaerts
Angstrom	Sissons
Baker-Pilliod	

As stated in Bulletin No. 88, each drawing is numbered, and this number is noted in the text describing the respective gears.

J. W. HACKWORTH

Timothy Hackworth, who did probably as much as anyone, not excepting George Stephenson, to improve the early locomotive, was a devout follower of John Wesley, and named his son after that famous founder of Methodism.

There is much in the careers of the Hackworths and Stephensons, father and son, that parallels. They were contemporary, both the younger practically grew up with the locomotive, and both were part and parcel of its development.

Born in 1820, J. W. Hackworth became an excellent mechanic and engineer and, when only sixteen, was sent by his father to St. Petersburg (now Leningrad) to erect the first locomotive ever shipped to Russia. He made the trip from an open Baltic port by sleigh, and was presented to the Czar. The engine, when erected, was consecrated with the baptismal ceremony of the Russian Orthodox Church.

Hackworth continued as manager of his father's locomotive works after the latter's death in 1850, built up a successful business, and originated many inventions. It was in 1859 that his first, and basic, patents for valve motion were issued, and from them sprang practically

all of the so-called "radial" gears. Perry, in "The Steam Engine" (1899), says "it is the parent of all radial valve gears." These number between twenty and thirty, and were simply variations of Hackworth's invention. They have been used on almost every kind of steam engine, but for various reasons never became popular in the locomotive field, except in the case of the Joy variety.

Hackworth took out further valve-motion patents in 1876, 1882 and 1886, and spent large sums in law suits against infringers. In the long run others reaped the benefits and thus he suffered the fate of many another inventor. He died in 1891, a highly honored man. The later years of his life were spent fighting to secure for his father the recognition he should have achieved, and against the assumption by others of the credit for many of the improvements devised by the older man, for whom his son had the deepest affection and admiration. Had it not been for these efforts on behalf of justice by his son, it is probable that our knowledge of the achievements of Timothy Hackworth would have been all but lost.

DAVID JOY

As the Joy valve gear has had a quite wide application, over three thousands to locomotives, and a large number to marine engines, the reader may like to know a little of its inventor.

David Joy was born in 1825, and, at eighteen, was in the drafting room of an English manufacturer, where he worked on the drawings of the Gray locomotive, the first one fitted with expansion gear and constant lead. This was a very complicated motion and it never became popular.

In 1879, while secretary of the Barrow Ship Bldg Co., Joy invented his famous radial gear. That same year it was tried out by Webb, the Locomotive Superintendent of the London & North Western Ry., and was used on many of that road's engines. From 1880 to 1888, it was fitted to more than 2900 locomotives on British Railways alone, and was applied to locomotives exported to India, South America, Russia and elsewhere.

In one of Joy's diaries he tells of Patrick Stirling, the noted Great Northern Locomotive Superintendent, asking him to make drawings of the motion for his famous eight-foot Singles. These striking engines, with their large drivers, were Stirling's joy and pride, and he was very particular about their appearance. They were first built in 1870, were of 4-2-2 wheel arrangement, with domeless boilers and 18"x28" cylinders, with inside valves and direct drive from link-motion. Joy painstakingly drew up the plans and showed them to Stirling who, after one look, told him that he "was not going to spoil his grand engine with the likes of that machinery outside her." His "eight-footers," as everyone called them, were built by him until his death in 1895, but the Joy gear never became part of them.

Joy in his later years, practiced in London as a Consulting Engineer, and died in 1903.

THE HACKWORTH VALVE MOTION OF 1859

(Dwg. 21)

The Hackworth gear, shown in the specifications of his first valve-motion patent of 1859, is the starting point for radial gears. In it the inventor worked out a much simpler form of mechanism than the then popular Stephenson Link Motion.

One of the claims for this gear was that it gave constant lead. This can readily be seen by making a small paper template to the size of the valve lever, marking on it the eccentric pin, valve-rod pin, and link-block pin centers. Drawing lines through the link center and within range of the reach rod throw, the path of the link-block pin center for any given cut-off (either forward or back motion) may be arrived at.

By placing the lower end of the template at any point on the eccentric pin path and the upper end on the link center line, the corresponding position of the valve-rod pin can be marked.

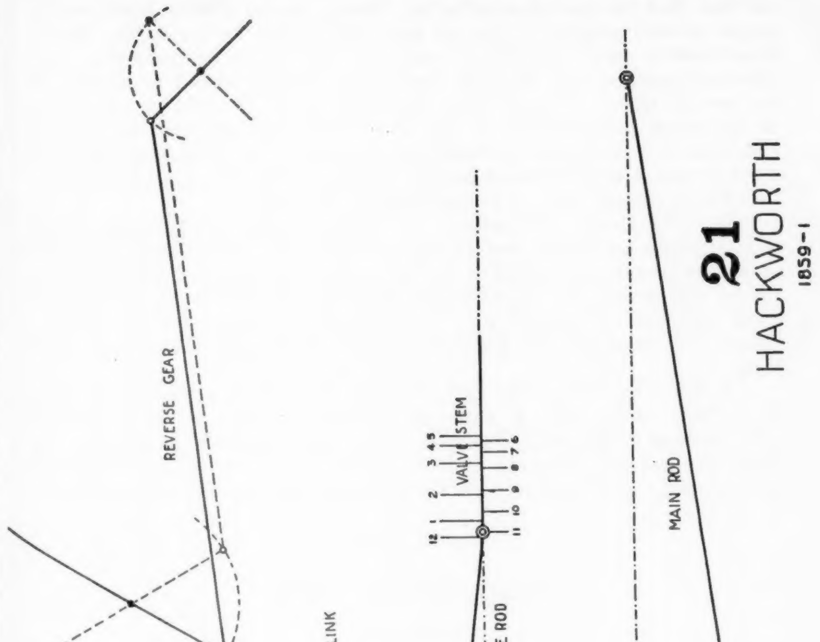
Following around the eccentric and link-block pin paths in this manner, the point paths of the pin at the outer end of the valve rod, for any position of the reverse lever, can be quickly found; and by using a similar template the length of the valve rod, the relative positions of the slide valve itself may be found. By this method, working first from the eccentric-pin path, it is a comparatively easy matter to work out the valve movement of any motion of the Hackworth type.

The distinguishing and characteristic feature of all the Hackworth gears is the *closed curve* described by the back end of the valve-rod. It may be of a symmetrical, flattened, or irregular shape, but of whichever type, it always provides for a constant lead.

By placing the reverse lever in the center notch the reversing link will be in a vertical position, the block traveling vertically to the extent of the eccentric throw. The oval shaped path of the intermediate pin on the eccentric rod will also be in a vertical position, and will give the lap and lead movement to the end of the valve-rod. Placing the link at an inclination will place the oval path of the intermediate pin on an angle, This gives the port opening of the valve.

It may be mentioned here that in the simpler forms, such as the one shown, Marshall's, Bremme's and some others, there is a slight error introduced in the position of the valve at all points except the central one, due to the angularity of the valve rod. This, however, has been corrected in some of the later types of Hackworth motions such as Joy's and Brown's, but, in so doing, some complication has necessarily been added. The explanation of these corrections is lengthy and involved and hardly belongs in a non-technical description.

Regarding Hackworth's gears, F. W. Brewer, in *Locomotive Magazine* (London), July 15, 1921, says, "In each one of his locomotives Strong employed grid-iron valves, and in all but his last engine, which was a four-cylinder compound, he used the Hackworth type of valve-motion. These were some of the few instances in which that gear,


21
HACKWORTH
1859-1
REVERSE GEAR
REVERSING LINK
VALVE ROD
VALVE STEM
MAIN ROD
VALVE LEVER
REACH ROD

virtually in its original form, had been applied to locomotives. Yet the fact that the motion adopted by Strong was in reality Hackworth's seems to have escaped notice; at any rate, so far as the writer knows, Hackworth's name has hitherto not been mentioned in connection with Strong's engines, and the gear has merely been referred to as 'one of the radial type.' The so-called Southern gear, brought out in 1914, is the latest development of the Hackworth valve-motion, and in all essentials it is identically the same arrangement used by Strong, although a return crank is substituted for an eccentric. The Joy gear, introduced in 1879, is simply another and an earlier variant."

In 1872, Hackworth came to the United States and Canada, partly to recuperate his health, and to introduce his gear, but the conservatism of motive power men nullified the later phase of his trip. The N. Y. C. placed the motion on one of its locomotives but, so far as the records show, this was the only case of its having been tried out. The Strong, Baker, and Southern, all based on Hackworth's gear, entered the field later.

A letter in "Engineering" (London, Vol. XLI, page 61) of June 21st, 1889, states that a valve gear identical with those of Brown (Switzerland), Marshall, Joy and others was patented in France, by Marquis de Solms, between 1845 and 1847, and that the specifications and drawings may be seen at the Conservatoire des Arts et Metiers, Paris.

HACKWORTH II. (1859)

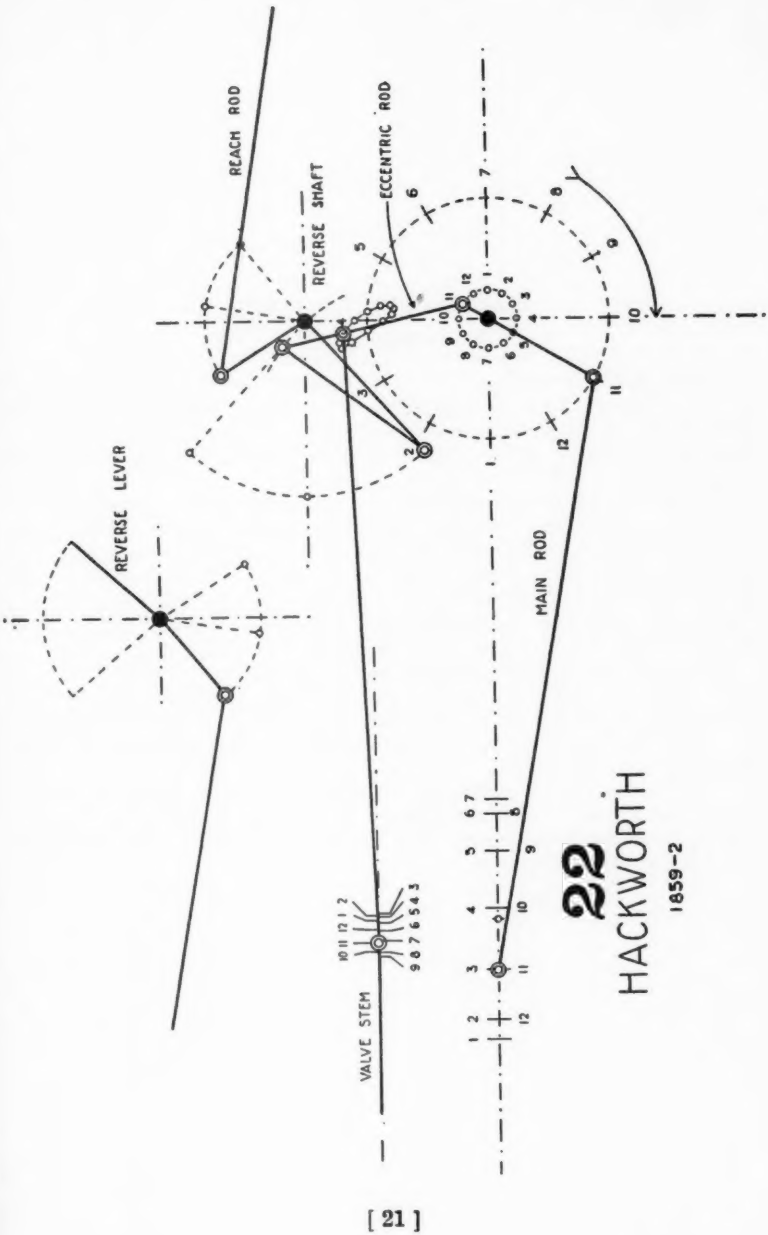
(Dwg. 22)

In this second example of Hackworth's gear the reversing and expansion link is done away with, and in its place a lift arm from the reverse shaft is provided. To the outer end of this lift arm a swinging rod is connected by a pin joint, and the other end of this rod is pin-jointed to the upper end of the eccentric rod.

The upper end of the eccentric rod, in this case, takes a curved instead of a straight path, and its intermediate connection (with the valve rod) describes a slightly different shaped oval from that given where the straight link is used.

As with the latter, the angle of the path is changed by moving the reverse lever, in exactly the same manner. The change caused by the arc of the swinging arm, when correctly calculated, allows for the error caused by the angularity of the valve-rod.

A comparison will show that Marshall's 1879 motion was a direct copy of this one; in fact, it was only one of the many that caused Hackworth to spend so much of his time and money in the courts.



22
HACKWORTH
1859-2

HACKWORTH III. (1859)

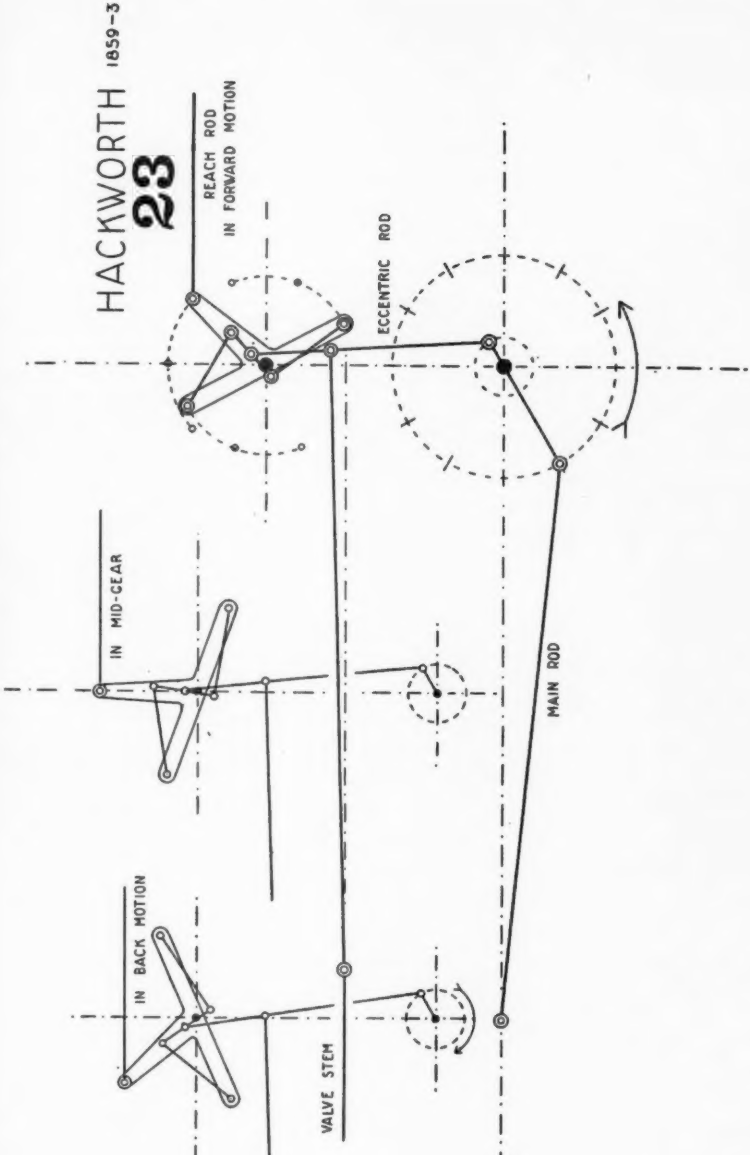
(Dwg. 23)

One of the motions patented by Hackworth, in 1859, incorporated quite a different form of linkage for reversal and expansion. Here the straight link is replaced by a series of three pin-jointed rods, the longer ones connecting at their outer ends with arms extending in opposite directions from the reverse shaft.

The two rods are pin-connected to a coupler, at the center of which is a connection with the upper end of the eccentric rod. This linkage is known as Watt's "Parallel Motion," and the eccentric rod connection at the center of this coupler is caused to travel in a straight line; just as in the original Hackworth gear with the straight link. The block is done away with, but the substitution of five pin joints is hardly to be recommended if the virtue of simplicity is to be considered.

One of Jack's valve-motions, based on Watt's parallel motion, is very similar to this one, except that the eccentric pin is on the same side of the wheel center as the main pin, instead of being opposite to it. Also, that the fulcrum (at the coupler) is below instead of above the valve rod connection.

In Hackworth's specification of 1859 is a fourth and more complicated gear which we have not shown. It is based, however, on the same principle as his other gears: the point of the valve rod connection traveling in a closed curve.


HACKWORTH 1859-3
23
REACH ROD
IN FORWARD MOTION
ECCENTRIC ROD
IN MID-GEAR
MAIN ROD
IN BACK MOTION
VALVE STEM

HACKWORTH, 1876

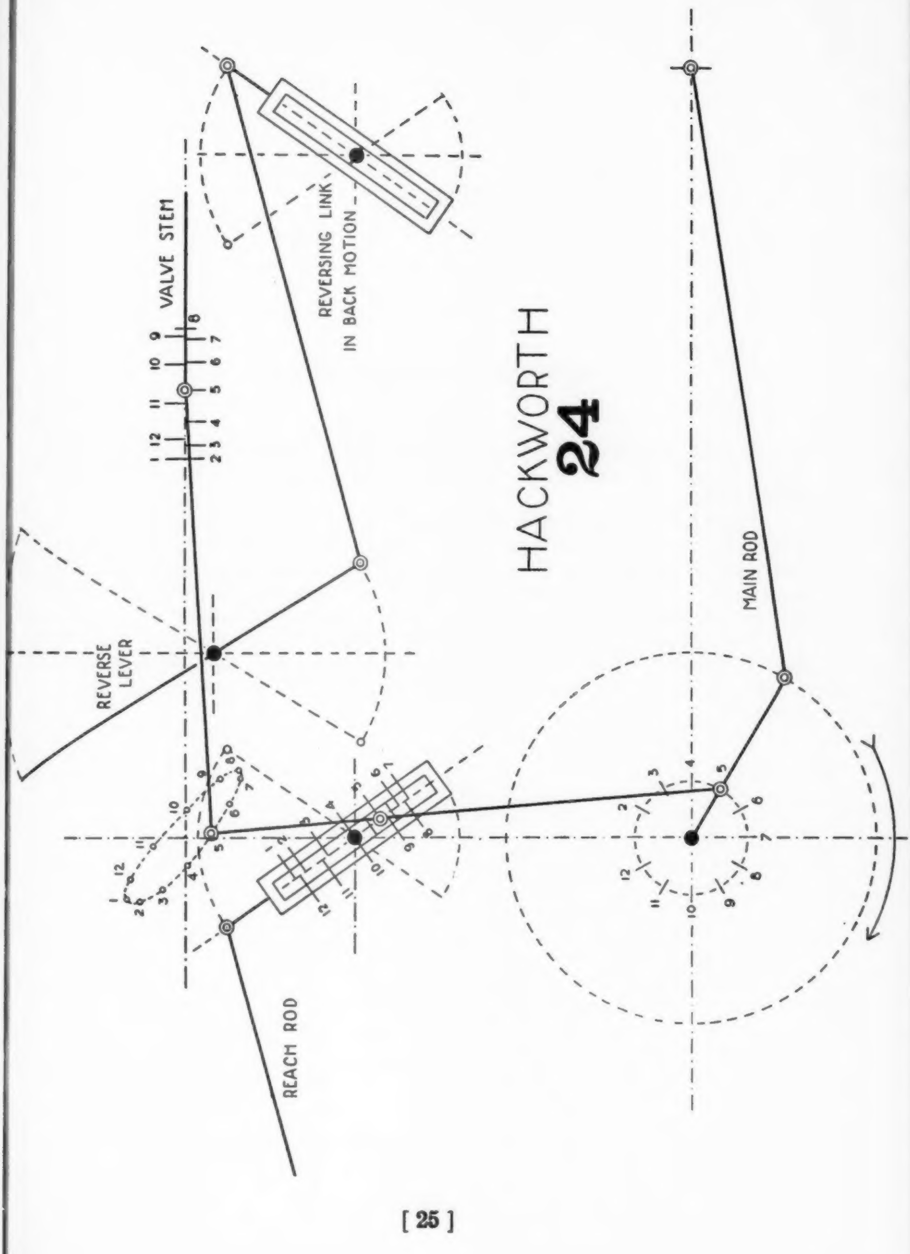
(Dwg. 24)

In 1876, Hackworth brought out another important modification of his first gear. Here again, the straight slotted link is used, but the fulcrum of the eccentric rod comes between the eccentric and the valve rod connection. The valve rod end describes the same characteristic oval path, and reversal is the same as in the earlier type.

An adaptation of this motion by the Netherlands Rys. (Holland) was fitted to a number of passenger locomotives in 1896. This arrangement will be shown later.

Hackworth's claims for this form, as against the link motions (Stephenson, Gooch, and Allen) universally prevalent at the time, were that it had greater mathematical correctness, a greater range of variation, constant lead, fewer parts, quicker opening and closing of the ports, a lengthened period of expansion, and less power absorbed in driving.

With these all-embracing claims it would seem that he had arrived at a very nearly perfect valve-motion. It was probably his best gear, and certainly one of the simplest that had ever been invented. One disadvantage in practise is the fact that the fulcrum being between the two ends of the eccentric rod, the stresses on this and the link are apt to be heavy; especially so when cutting off late in the stroke, as with a heavy train, or on a steep grade.


VALVE STEM
REVERSING LINK
IN BACK MOTION
HACKWORTH
24
REVERSE
LEVER
MAIN ROD
REACH ROD

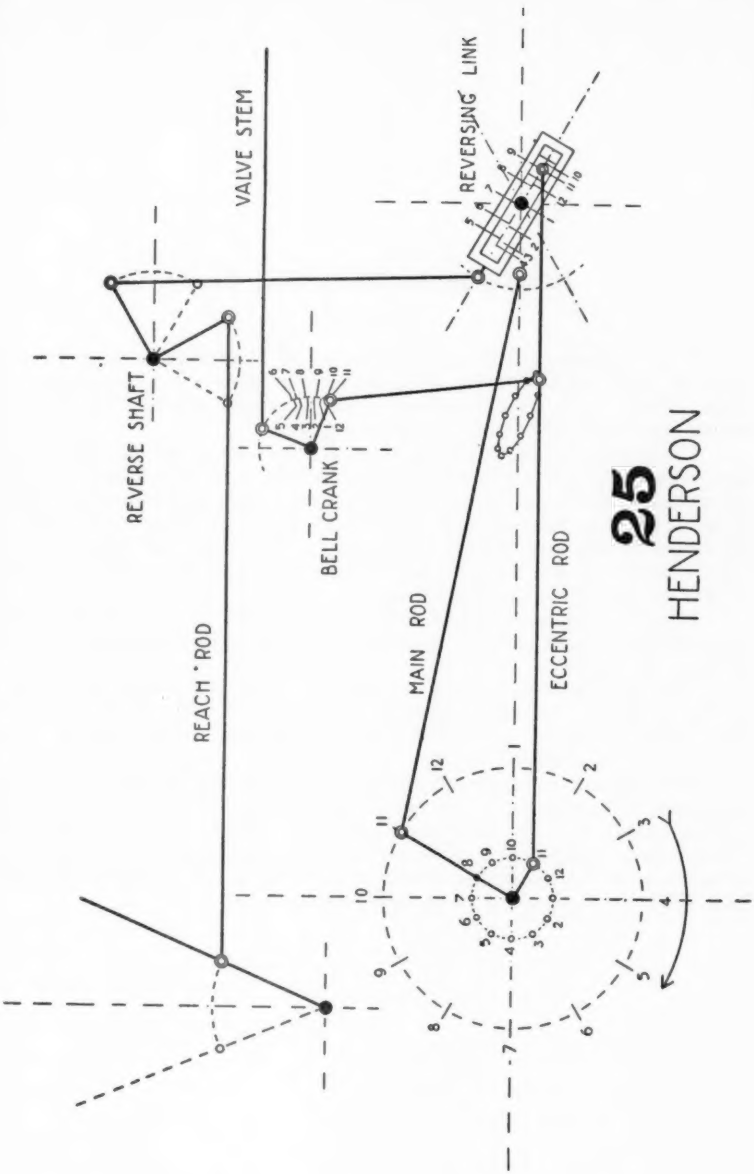
HENDERSON-HACKWORTH

(Dwg. 25)

A valve motion brought out in 1886, using Hackworth's slotted link and driving the valve-stem through a bell-crank, was brought out by Henderson.

This gear is the simple Hackworth motion placed horizontally, instead of vertically, in relation to the center line of the engine. Due to the position of the link, the eccentric is set on a line quartering with the main pin, and the vertical movement of the bell-crank rod is converted by the bell-crank to a horizontal movement of the valve-stem.

This gives steam distribution identical with Hackworth's earliest slotted link type. About all that can be said for the Henderson motion is that it is a more complicated arrangement for producing the same results.


REVERSING LINK
VALVE STEM
REVERSE SHAFT
BELL CRANK
REACH ROD
MAIN ROD
ECCENTRIC ROD
25
HENDERSON

HACKWORTH (Netherlands Rys.)

(Dwg. 26)

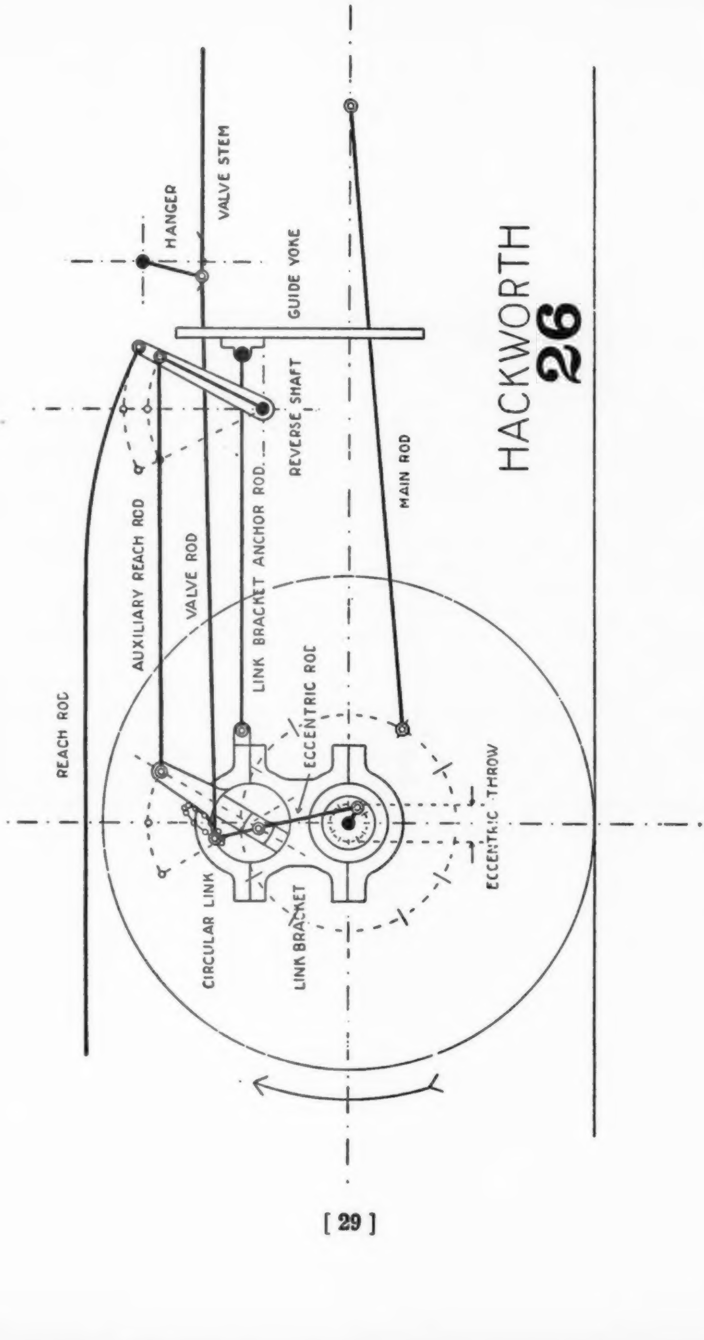
This illustration shows an application of Hackworth's later (1876) gear as fitted to a number of Netherlands State Rys. locomotives in 1926. These were 4-4-0, inside-cylinder passenger engines, the first of which was equipped with Lentz poppet valves.

The circular straight-slotted links are held stationary by the auxiliary reach rod, and can be moved from full forward to full back motion. These links revolve in the upper bearing of a three piece bracket which, in turn, bears on the main axle, and which is kept in an upright position by means of the link bracket anchor rod. This is for the correction of errors caused by the rise and fall of the engine frame due to the action of the springs when on rough track.

These engines, with their inside cylinders, had only one of these link brackets, both right and left side links working in this bracket, which is between the cranks.

The valve gets its motion through the usual connection to the pin at the upper end of the eccentric rod, the path of which is shown as in full forward motion. The inclination of the slot in the circular link determines the point of cut-off.

The engines so equipped showed a substantial saving in fuel as compared with engines of the same class having Walschaerts gear and piston valves, but, by 1935, they were all rebuilt with the standard Walschaerts equipment. This combination, together with superheat seems to spell the most reliable and least costly means of steam distribution when all factors are taken into consideration.


HACKWORTH
26
VALVE STEM
HANGER
GUIDE YOKE
REVERSE SHAFT
MAIN ROD
LINK BRACKET ANCHOR ROD.
VALVE ROD
AUXILIARY REACH ROD
REACH ROD
ECCENTRIC ROD
ECCENTRIC THROW
CIRCULAR LINK
LINK BRACKET

SENTINEL-HACKWORTH

(Dwg. 27)

The Egyptian State Railway, which has done a very considerable amount of research work in the development of the steam locomotive, built a series of four geared locomotives with conventional frames and boilers. These were the 2-2-2-2 type, with pairs of 11″x12″ cylinders geared to each of the second and third axles. No side rods were used.

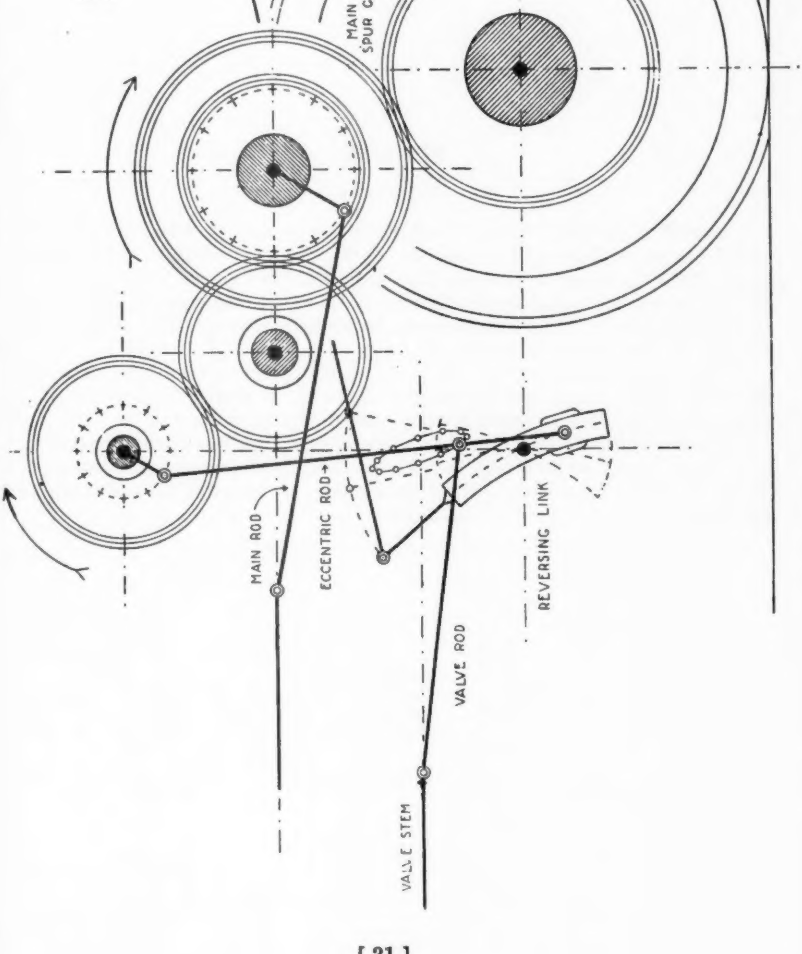
The Sentinel engine was originally developed for use in steam-driven passenger cars and light locomotives, many of which are still in use. In this example the design has been adapted to a full size standard gauge main line locomotive, a boiler pressure of 200 lbs. being used.

The engine is slung from the driving axle, and steam and exhaust pipes are fitted with ball and socket joints. The drivers of these particular engines were 44¾ in. in diameter.

The valve motion is driven from an independent shaft by an idler geared to the engine shaft. Piston valves are employed, the valve chests being placed beneath the cylinders. The whole is enclosed, and gears and other moving parts lubricated by spray, forced feed, or oil bath.

This motion is an adaptation of the Hackworth principle, reversal being taken care of as with the Joy gear. For convenience, the drawing shows a 36 inch driving wheel.

27 SENTINEL-HACKWORTH



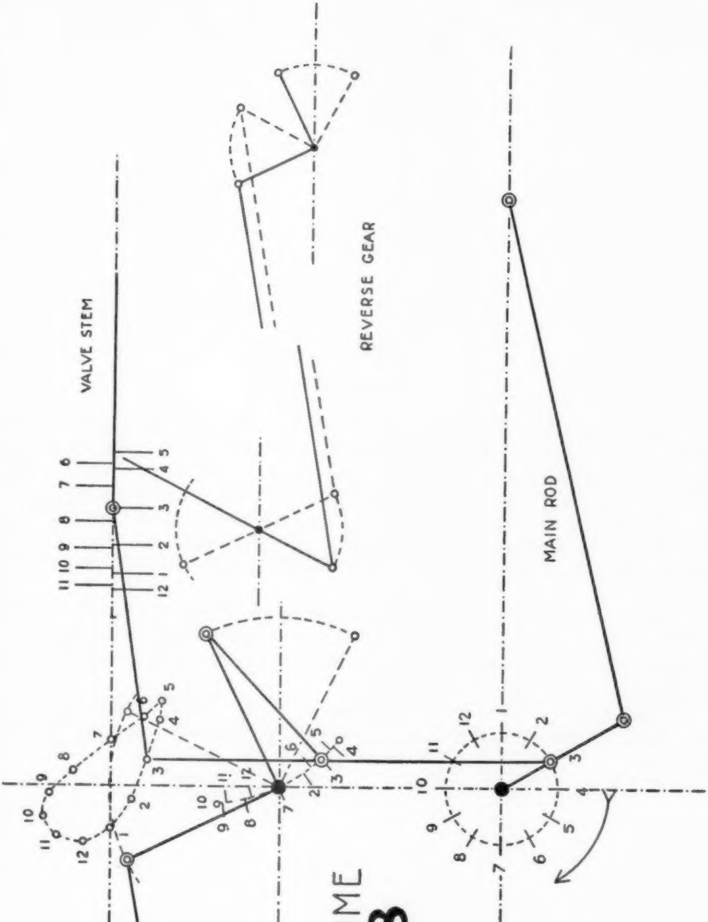
BREMME

(Dwg. 28)

Another version of the Hackworth motion, this was brought out about the same time as Marshall's. It will be noticed that, while there is a similarity between the Bremme and Marshall gears, the connection of the valve rod to the eccentric rod is above the fulcrum of the latter instead of below. This necessitates the eccentric connection on the side of, and in line with, the crank-pin.

The path of the valve rod back end is quite different from those given by either Hackworth's straight slotted link or Marshall's swinging arm; however, valve events are not materially altered.

Hackworth's 1879 motion with his slotted link has been illustrated, and it can easily be seen how this motion may have suggested Bremme's. Both of these have seen considerable use in locomotive and marine practice.


VALVE STEM
REVERSE GEAR
MAIN ROD
REACH ROD
BREMME
28

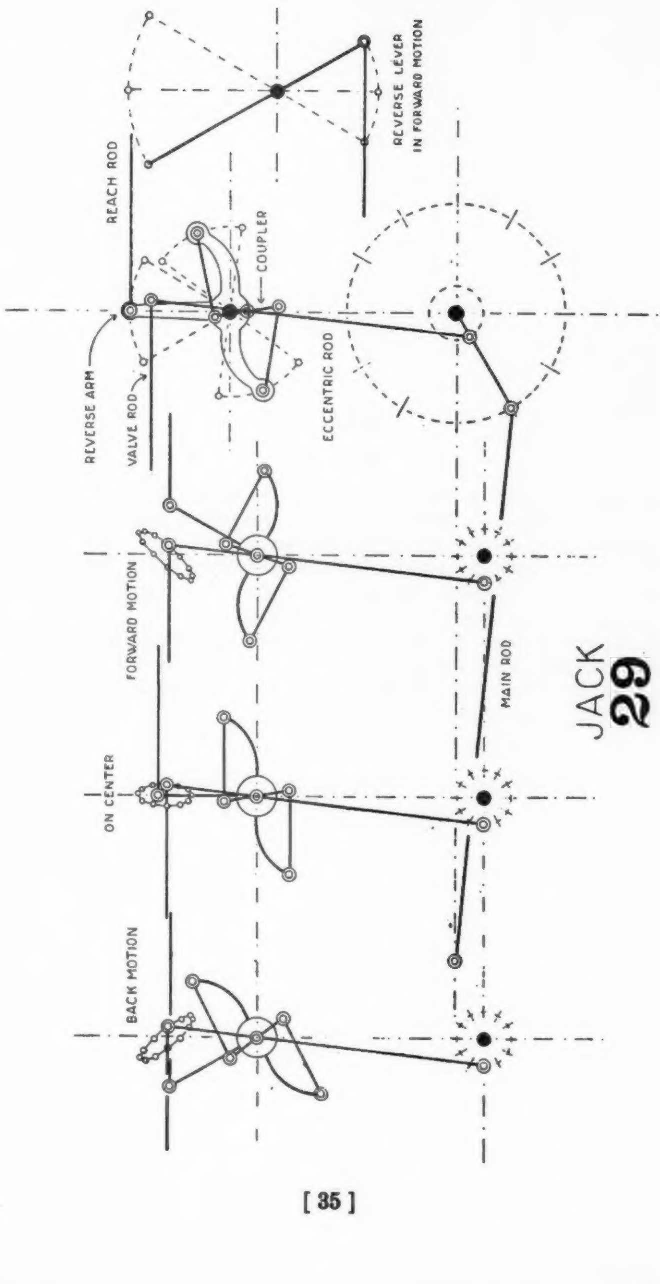
JACK I.

(Dwg. 29)

This valve gear, brought out in 1889, is a modification of Hackworth's 1879 patent. The reversing mechanism is very similar in principle to Angstrom's, with its two hanger arms on the reversing shaft, and a parallel motion. This parallel motion, though, is placed between the two ends of the eccentric rod, where Angstroms is at the upper end. Furthermore, in Jack's gear the line of motion at the center of the coupler link is a straight one, whereas, in Angstrom's, it is a reverse curve.

Jack's motion gives identical steam distribution with that of Hackworth's 1879 patent previously shown, the structural difference being that the parallel motion linkage is substituted for Hackworth's slotted straight link; a dubious advantage.

The illustration shows the motion on center, in full forward, and in full back motions; the respective paths of the valve rod connection being apparent.


REACH ROD
REVERSE LEVER
IN FORWARD MOTION
COUPLER
REVERSE ARM
VALVE ROD
ECCENTRIC ROD
FORWARD MOTION
ON CENTER
BACK MOTION
MAIN ROD
JACK
29

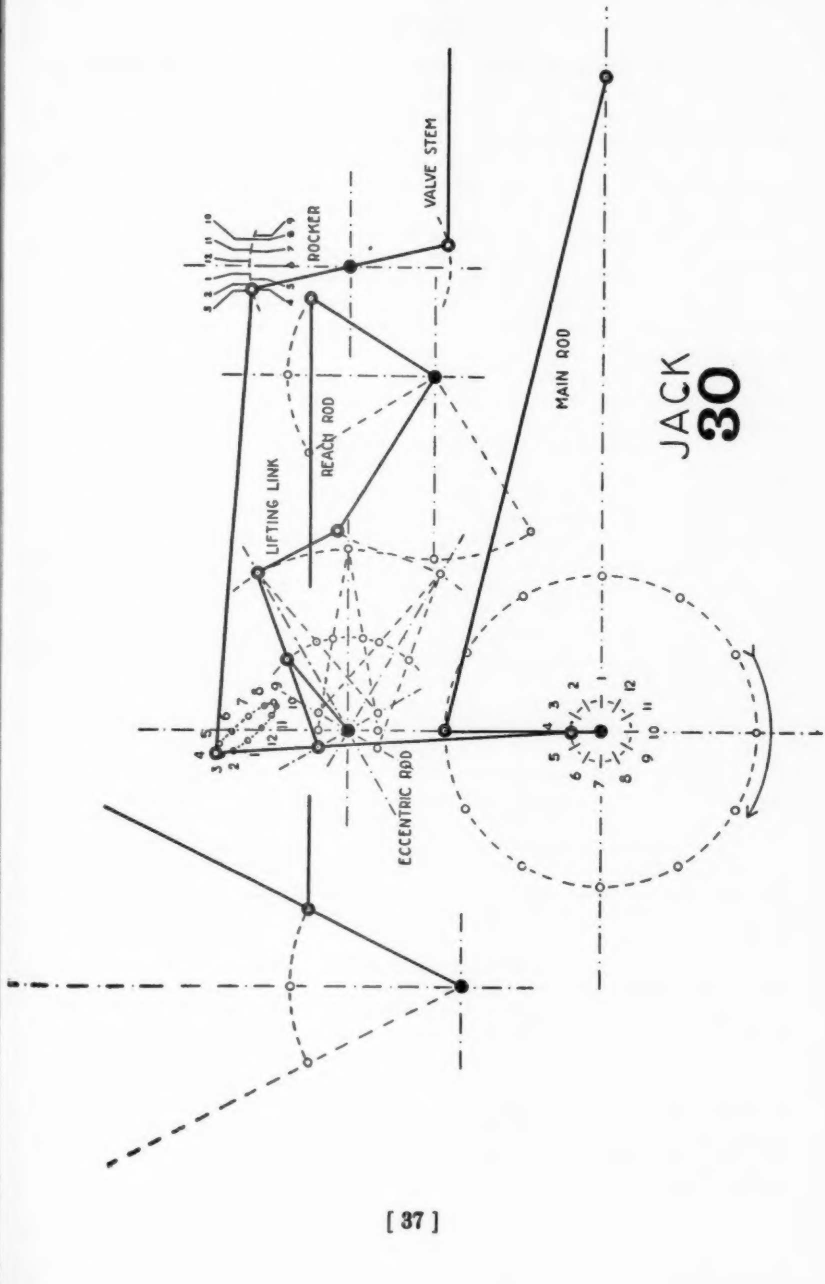
JACK II.

(Dwg. 30)

In another gear of Jack's, brought out about the same time as the one previously shown, a different method is used to produce the straight line motion of the fulcrum of the eccentric rod.

This valve motion gives the same distribution as the other Jack motion, but in a simpler manner; and there are no sliding surfaces, such as are used in Hackworth's 1876 motion.

As shown, it is an indirect motion (with rocker), but, by shortening the eccentric rod, eliminating the rocker, and altering the reach rod connection to the reversing shaft, it can easily be converted to a direct motion gear.


VALVE STEM
ROCKER
REACH ROD
LIFTING LINK
MAIN ROD
ECCENTRIC ROD

JACK 30

JOY I.

(Dwg. 31)

This form, the most widely used of any of the several arrangements of the Joy valve motion, came out in 1879. It was popular to some extent in England, notably on the London & North Western. Only a very few American locomotives were ever fitted with it.

At first glance it seems to be in a class by itself; but examination will show that it is based on the Hackworth principle. The drive is off the main rod, as in Brown's variety of Hackworth gear, but the curved reversing link functions in a manner similar to Marshall's, in that it changes the path of the upper end of the valve lever to a like pattern, the characteristic oval given the valve rod end.

The link is attached directly to the reverse shaft, and moves only with the reverse lever. In either full forward or back motion it attains its greatest angle, and the sliding of the block, always for the full distance, naturally gives the valve greater travel than when the reverse lever is hooked up and the inclination of the link less. The coupler arrangement is corrective.

The Joy motion goes ahead of other gears, theoretically, in providing good steam distribution; it cost 25% less than link motion to construct, and was lighter. If properly set, lead and cut-off could be equalized for both ends, at all positions of the reverse lever; and lastly, being an outside gear, it was more accessible for oiling and repairs.

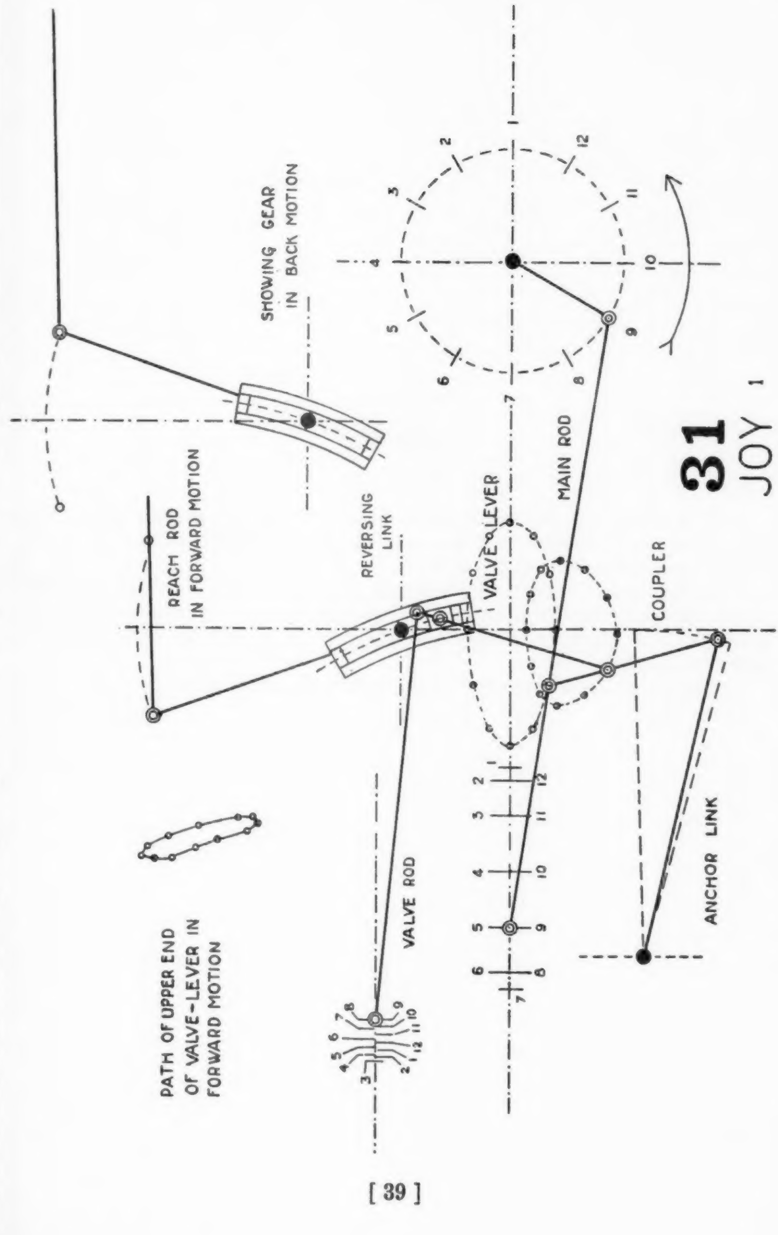
It would seem that, with all these advantages, it should have enjoyed an almost universal application; but in practice it didn't show up so well. First, when running, vertical displacement, due to movement of the driving axle in relation to the frame, acted directly on the valve. Second, though this would be more apparent in freight hauling, due to the position of the link when working with a late cut-off and full throttle, pressure on the slide-valve and the angularity of the link made for heavy wear between the link and block. This, of course, lessened as the engine was hooked up. To remedy this, the springs for the main axle (in England many locomotives were not fitted with equalizers) were stiffened, a case of introducing one evil to get rid of another. Third, the initial driving point of this motion tends to weakness in the main rod.

These defects in practice were sufficient to keep the Joy motion from becoming very popular in the locomotive field, though it is possible that the Walschaerts gear, having many of the advantages of the Joy motion, without its disadvantages, may have had much to do with the latter's failure to arrive.

By 1920, there were not many examples of the Joy gear in use, and for years it has been regarded as obsolete.

Note. An application of Joy motion was made to some Philadelphia & Reading 3-cylinder Atlantics being used for the inside cylinder. It was also applied to the P. R. R.'s Webb compound of the '90s.

David Joy, whose valve motion was quite extensively used on marine engines, was a noted engineer. He was secretary of a large ship building company when he invented his valve gear; and at the time of his death, in 1903, was active as a consulting engineer in London. He was 78 years of age.


SHOWING GEAR
IN BACK MOTION
REACH ROD
IN FORWARD MOTION
REVERSING
LINK
VALVE LEVER
MAIN ROD
COUPLER
ANCHOR LINK
VALVE ROD
PATH OF UPPER END
OF VALVE-LEVER IN
FORWARD MOTION
31
JOY 1

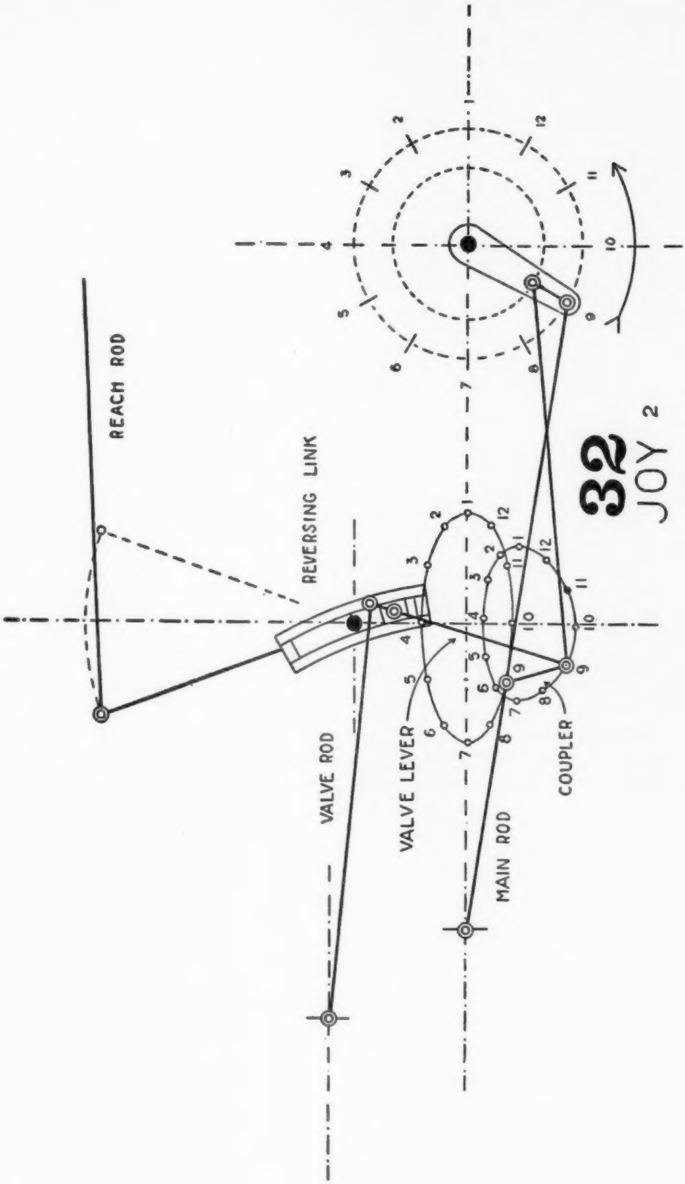
JOY II.

(Dwg. 32)

This form of Joy's gear was designed for use on narrow gauge and other low wheel engines, the anchor link of the conventional type being unsafe because too near the ground.

In this type the drive is from two points; the main rod, and a short return crank from the main pin. These can be so proportioned that the point path of the lower end of the valve lever will be the same as when using an anchor link.

Otherwise the motion is identical with the first type.


REACH ROD
REVERSING LINK
VALVE ROD
VALVE LEVER
MAIN ROD
COUPLER
32
JOY 2

JOY III.

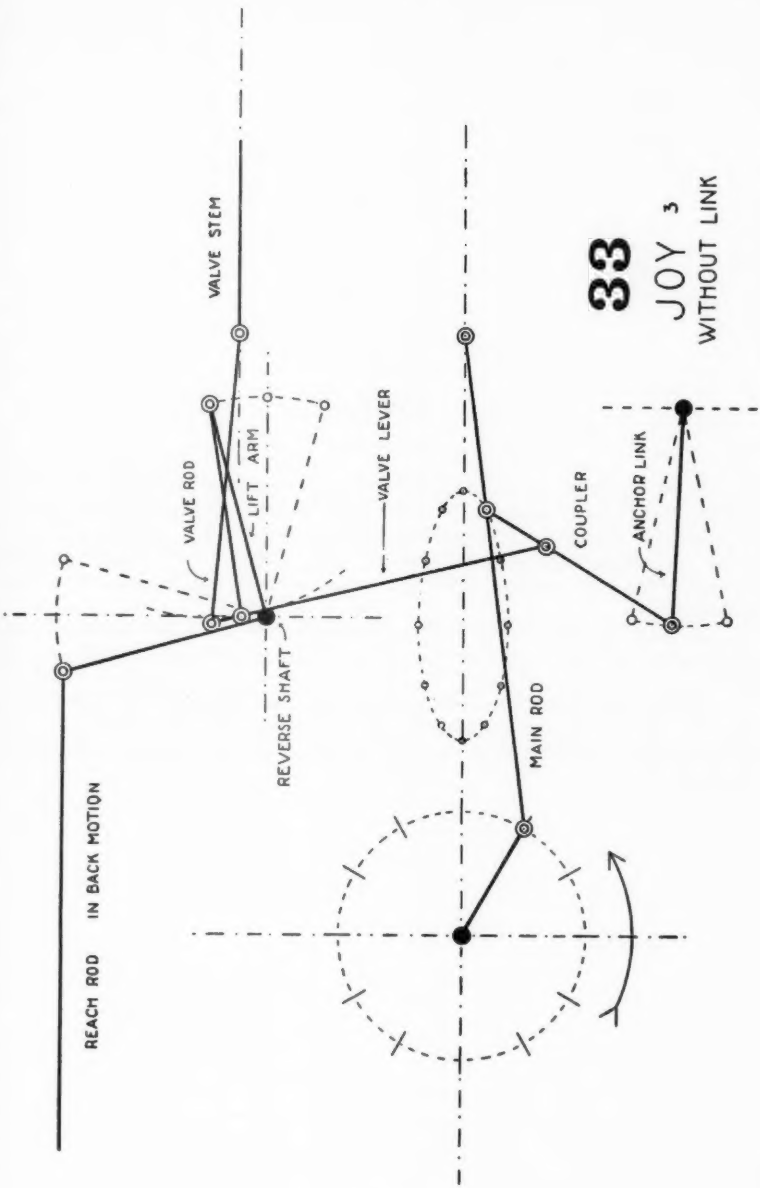
(Dwg. 33)

This arrangement of Joy's motion is like the others, in that it is based on the Hackworth principle.

The drive is the characteristic Joy drive, in that it is taken off the main rod back of the cross-head, and through an intermediate linkage to the valve lever. Here the resemblance ends, for the upper end of the valve lever moves in a constrained path in a manner identical with that in the Bremme and Marshall gears; reversing also is effected in the same way.

It might be termed a Joy-Bremme motion, as it has the correcting features of the former in its lower parts, and the expansion control and reversing details of the latter at the upper end of the valve lever.

This gear can be laid out to give distribution identical with that of the conventional Joy reversing link, doing its work with pin joints instead of the sliding block.



33
JOY 3
WITHOUT LINK

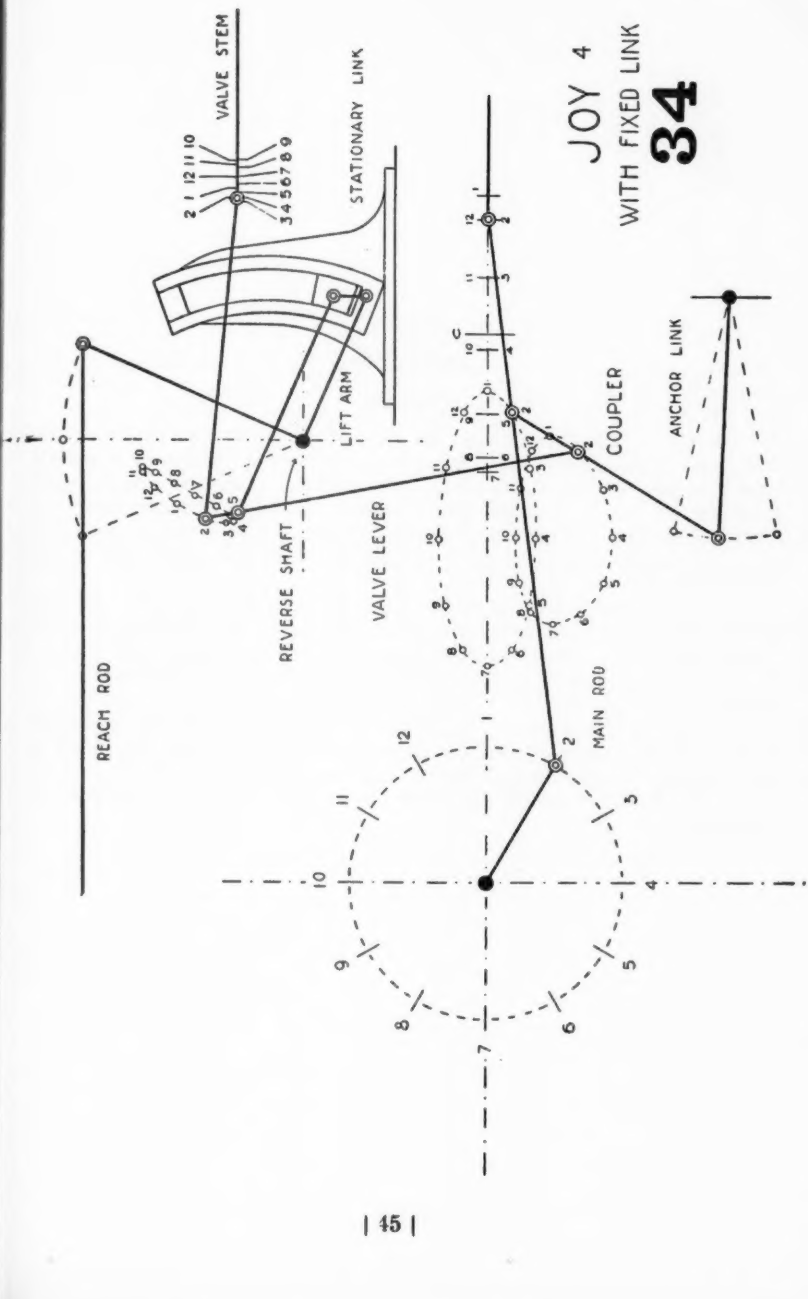
JOY IV.

(Dwg. 34)

Here we have the same distribution of steam as given by the other varieties of the Joy motion, the difference from the one previously shown being in the use of a fixed vertical link for reversing. In fact, we have come upon something almost identical with Strong's first design for the motion of his experimental 4-6-2 locomotive in 1886, No. 444 of the Lehigh Valley.

By placing the reverse shaft of the Joy gear ahead of the link, and the anchor link and coupler above the main rod, we have this Strong gear.

While this arrangement is perhaps more complicated and expensive, the use of the fixed link enables the block to take the thrust of the motion, and makes hooking up and reversing an easy matter, even with an open throttle.



JOY 4
WITH FIXED LINK
34

ANGSTROM

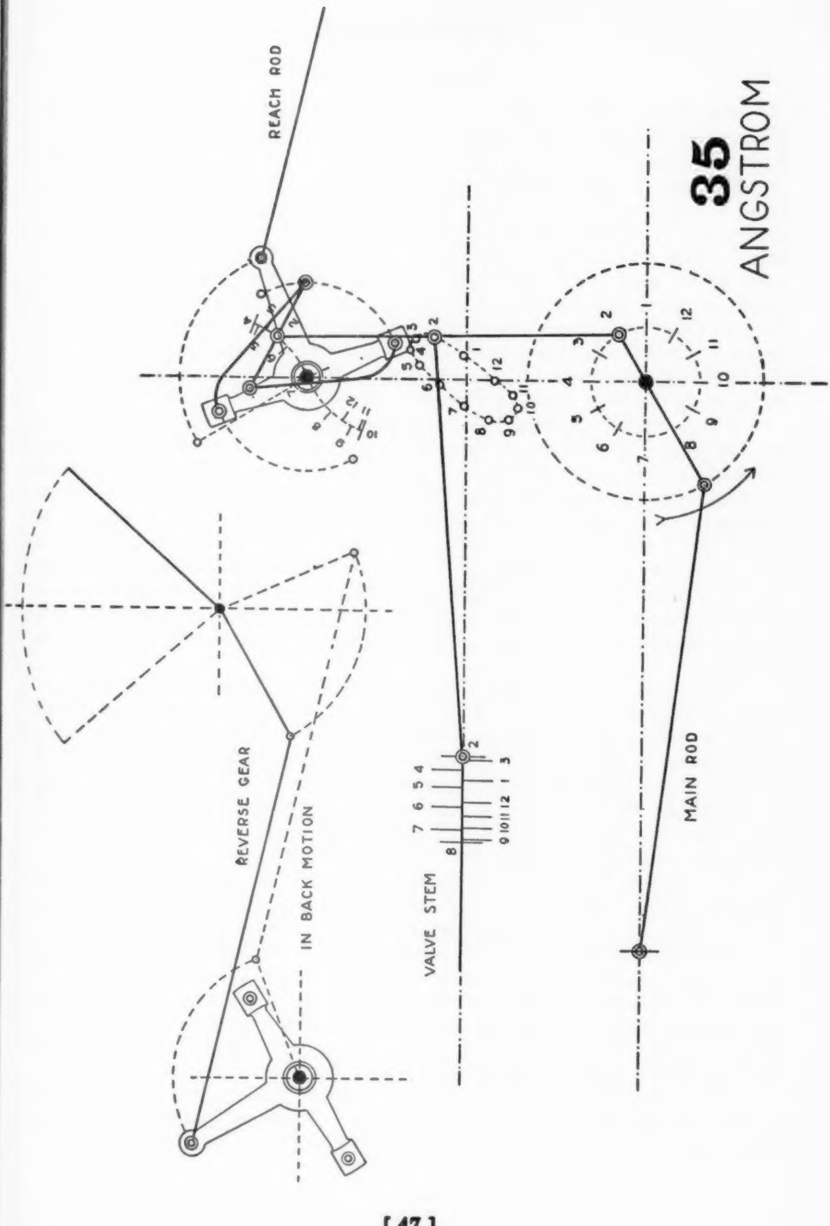
(Dwg. 35)

In the Angstrom gear, which is another variant of Hackworth's, the path of the upper end of the eccentric rod is guided in a reverse curve by the system of swinging links shown. Here the reverse shaft is equipped with two arms, to the outer end of which are hung the swinging links. Connecting these two links is a coupler, at the mid-point of which is a pin-jointed connection with the upper end of the eccentric rod.

The Angstrom gear gives to the back end of the valve rod the closed curve path, characteristic of all motions of the Hackworth type. Variations in the paths of the upper end of the valve rod in these different gears naturally make for slight differences in steam distribution.

Owing to the large arc involved in the reversal of the Angstrom gear, a worm type was used in place of the usual reverse lever. The conventional reverse lever is shown here merely for convenience.

Aside from the complications of this motion, no further comment is necessary.


REACH ROD
REVERSE GEAR
IN BACK MOTION
VALVE STEM
MAIN ROD
35
ANGSTROM

BAKER-PILLIOD

(Dwgs. 102-103)

The Baker-Pilliod valve motion was first applied to T. St. L. & W. No. 157, a Baldwin ten-wheeler, in 1908. It was used also on the C. & A., Hocking Valley, Central of Georgia, C. G. W., and other roads.

Because of the difficulty in showing the operation of this motion from a working drawing of an actual installation, the diagrams of the examples shown are not in proportion to insure proper steam distribution. They do, however, show the relation of the various members to each other, and their functions. As in the Baker gear, most of the working parts are carried in a cradle extending from the guide-yoke back to the lift shaft and, as in several other motions, the usual eccentric crank is employed; also a combination lever and union link, the latter's connection to the cross-head being either direct, from a yoke extending down from the cross head, or from a horizontal yoke.

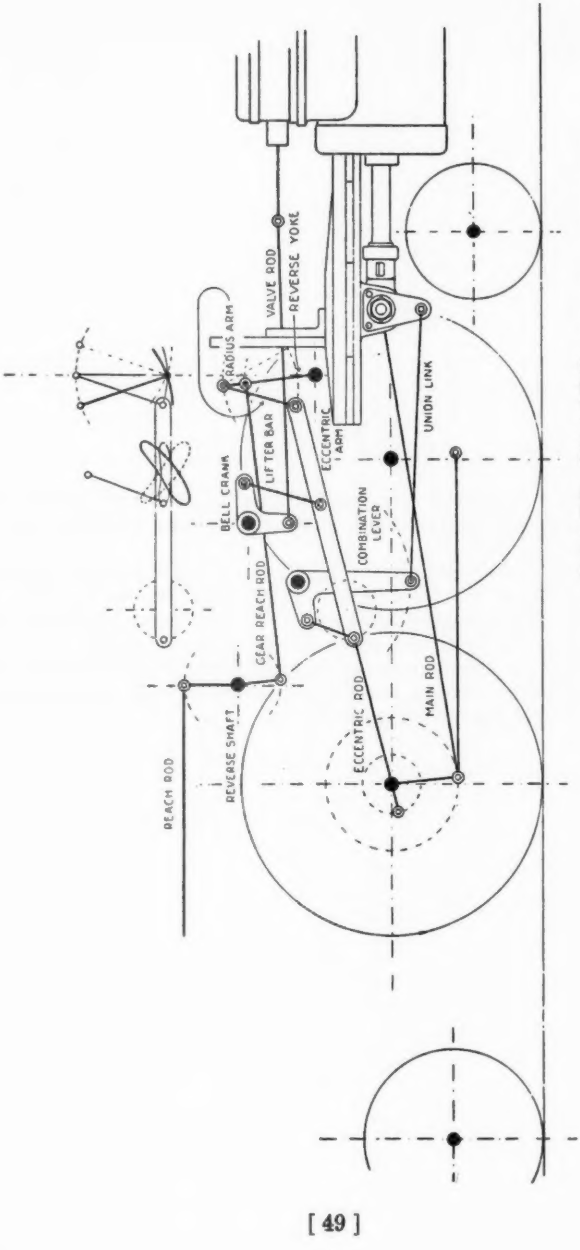
The so-called combination lever functions as a bell-crank, the short arm of which is connected by a short link to the forward end of the eccentric rod and the rear end of the eccentric arm. When the engine is in motion, the point of this connection moves in a cirelc of the same radius as the eccentric pin path. From here on we have a variety of the Hackworth motion not unlike the Baker. The eccentric rod of the B-P gear travels in parallel, similar to the motion of a locomotive side-rod, and the forward end of the eccentric arm describes an arc, the radius of which is governed by the length of the radius arm, and the direction, by the reverse yoke. Lead, as in all gears of the Hackworth type is constant.

The usual broad claims were made for the Baker-Pilliod, some of them doubtless warranted: light weight, a very short eccentric throw (6½" to 7"), a greater range of valve events, extremely quick opening and closing of ports, high effective pressure, constant lead, efficiency at high speed equal to that of gears with from two to four valves, and a guarantee to produce a saving of 5% in fuel and an increase of 5% in actual tractive power. Two drawings are shown, one example being for outside, the other for inside admission.

As with Baker, Walschaerts and others, this means changing the position of the eccentric pin. With the Baker-Pilliod gear the position of the short arm of the combination lever is also altered.

The small sketch above the drawing of the outside admission variety shows the approximate paths of the lower end of the lifter bar at different positions of the reverse lever. When in the center notch, the reverse yoke, radius arm and lifter bar are shown in light lines, also the path of the lower end of the lifter bar. This shows that only lap and lead movement are provided for.

When the reverse lever is in full forward motion, the forward end of the eccentric arm travels in a different direction, due to the reverse yoke having moved to a different angle as shown by the heavy line.



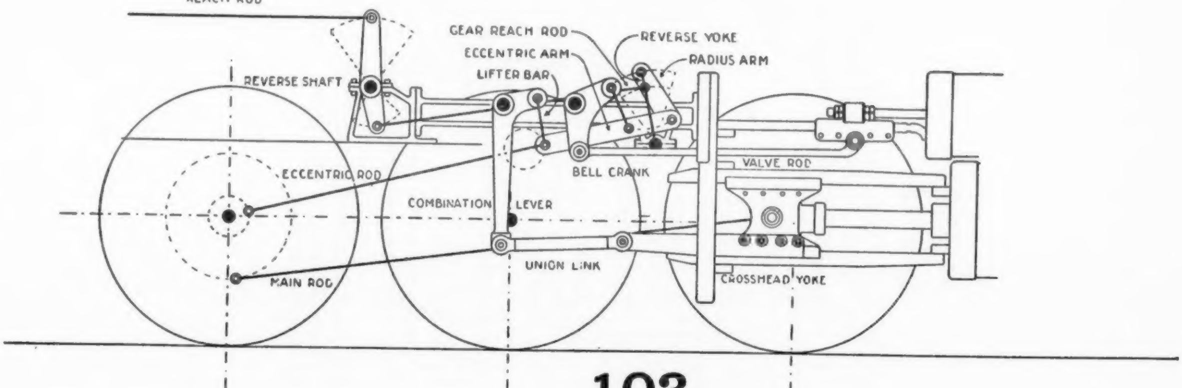
BAKER-PILLIOD OUTSIDE ADMISSION

102

Here, too, the lower lifter bar point travels on the heavy curve. When in full back-motion, dotted lines show the various members and their respective paths.

These paths show plainly the amount of vertical motion imparted to the upper arm of the bell-crank which moves the valve rod. They constitute the characteristic Hackworth "closed curve" patterns, which can be designed to fit almost any valve-gear requirements.

In spite of its good points the Baker-Pilliod gear had a very limited application and was soon a has-been, due probably to a multiplicity of parts. The Baker gear fared much better.



103

BAKER-PILLIOD INSIDE ADMISSION

BAKER I.

(Dwg. 36)

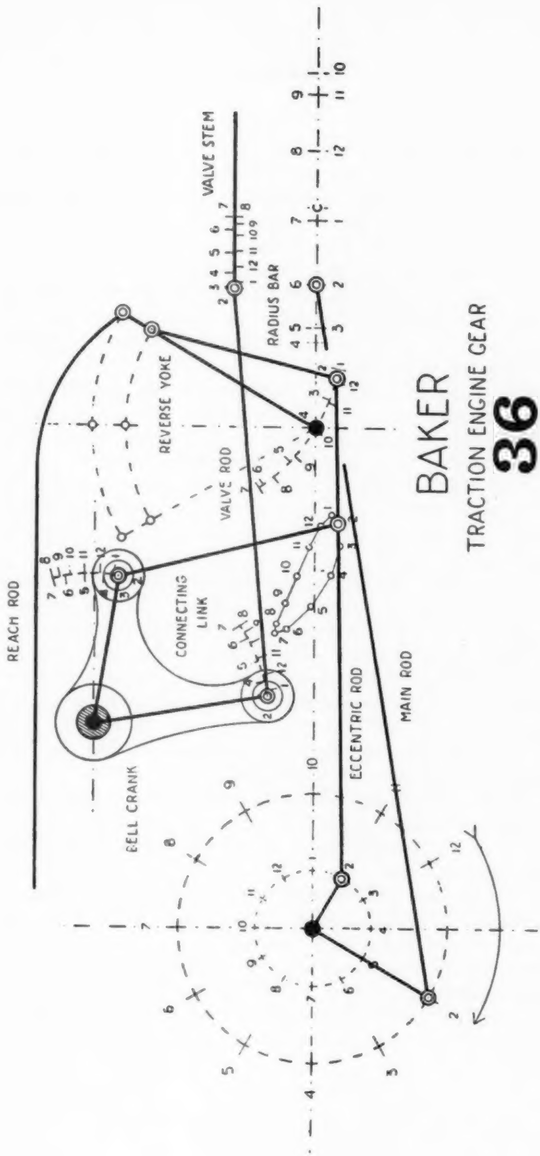
Patented in March, 1903, by Abner D. Baker, this gear was the forerunner of one of the more popular locomotive valve motions in this country. It was designed originally for traction engines, in which steam chests were placed between the cylinders. The motion on each side was driven by one eccentric. To show more clearly its working, the illustration shows the valve stem as above the plane of the piston rod. The design is for an outside-admission slide valve.

The drive is very similar to that of the Marshall gear except that instead of the eccentric rod being driven from a point opposite the main pin, it takes its drive from a point quartering with the latter. The connecting link drives off the eccentric rod and works through a bell-crank.

It will be seen that this Baker gear is a direct development of the Hackworth principle, the radius bar working through an arc, the lower end of connecting link working through a closed curve of the characteristic Hackworth type, and the ratio of the two ends of the eccentric rod governing the amount of lead, which, in this case, is constant.

An understanding of the movement of the different parts, as shown by the carrying through of the point paths in the illustration, will make easily apparent the further development of this forty year old traction engine gear into the splendidly designed Baker locomotive valve motion of the present day.

This traction engine gear is almost identical with one of the valve motions invented by Chas. Brown, of the Swiss Locomotive Works, about twenty-five years earlier (1878).


BAKER
TRACTION ENGINE GEAR
36
REACH ROD
BELL CRANK
CONNECTING LINK
REVERSE YOKE
VALVE ROD
VALVE STEM
RADIUS BAR
ECCENTRIC ROD
MAIN ROD

BAKER II.

(Dwg. 37)

In the development of his locomotive valve gear from the older traction engine gear, Mr. Baker cut off the forward end of the eccentric rod at the lower end of the connecting link to the bell crank. This connecting link is made with a slight turn, its upper end connecting to the horizontal arm of the bell crank.

The vertical arm of the bell crank imparts its motion to the valve rod through a point near the upper end of the lap and lead lever. This lap and lead lever functions exactly as does that in the Walschaerts gear, regardless as to whether the union link extends forward or back from the cross-head connection.

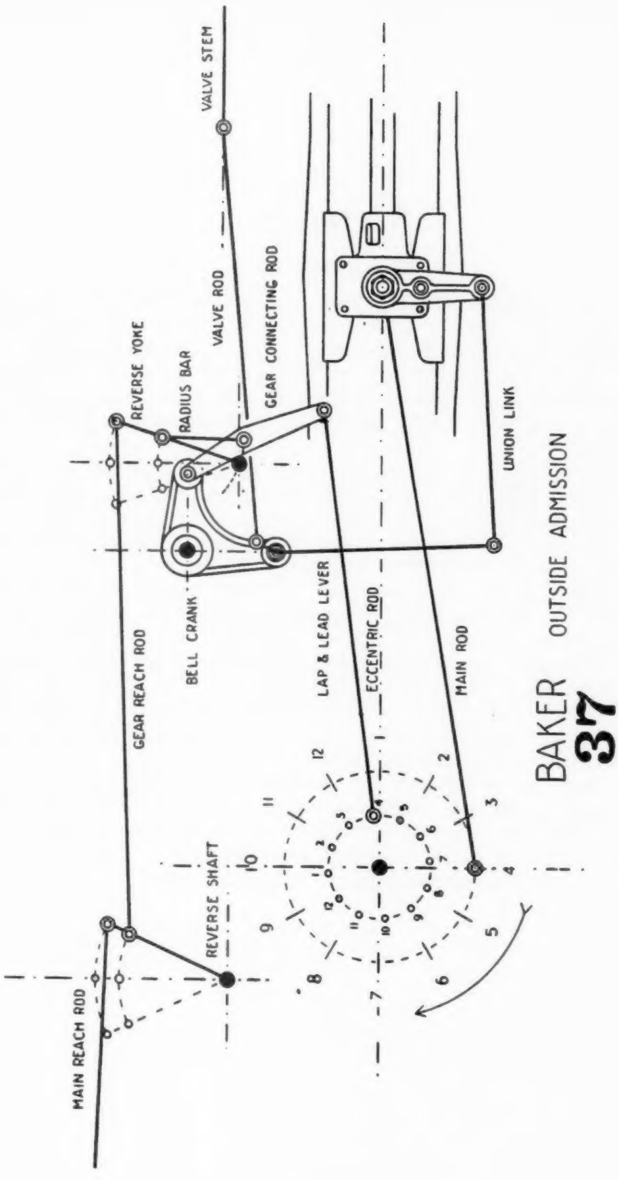
So here we have a gear that partakes of the characteristics of two basic motions; Hackworth and Walschaerts. Reversing of, and cut-off in valve travel, are effected as in the Hackworth plan, while the lap and lead arrangement is purely Walschaerts'.

The use of the bell crank is incidental, and changes the position of the eccentric or return crank to a point quartering with the main pin instead of opposite to it, as is the case with the Marshall variety of the Hackworth motion.

While at first sight the Baker gear appears to have a superabundance of parts, it is simple in design and efficient in performance. It is particularly applicable to heavy locomotives, as is it can be proportioned to use with long travel valves. Doing away with link and block, there are no sliding surfaces, the only wearing parts being pins and bushings. At these points any slight wear may easily be taken up by the replacement of the bushings without the necessity of resetting the valves. Further, the application of needle roller bearings can be made at any of these parts, cutting wear to a minimum.

All in all the Baker gear has developed into a sound and efficient gear which transmits motion to the valve in a straight line, gives good distribution of steam, and is light in weight, moving parts considered. Maintenance costs are low.

(Note: When this gear was introduced for locomotive use, it was called the Baker-Pilliod valve gear. The name Pilliod was later dropped from the name of the gear, and another valve gear, cross-head driven, was marketed under the name of the Pilliod Valve Gear. The first Baker-Pilliod Gear was applied to Toledo, St. Louis & Western No. 157, in 1908, and the first Baker Valve Gear was applied to Toledo Terminal R. R. No. 2, in 1910. It has been installed on over 15,000 locomotives. Editor.)


VALVE STEM
VALVE ROD
GEAR CONNECTING ROD
REVERSE YOKE
RADIUS BAR
UNION LINK
GEAR REACH ROD
BELL CRANK
LAP & LEAD LEVER
ECCENTRIC ROD
MAIN ROD
REVERSE SHAFT
MAIN REACH ROD
BAKER
37
OUTSIDE ADMISSION

BAKER III.

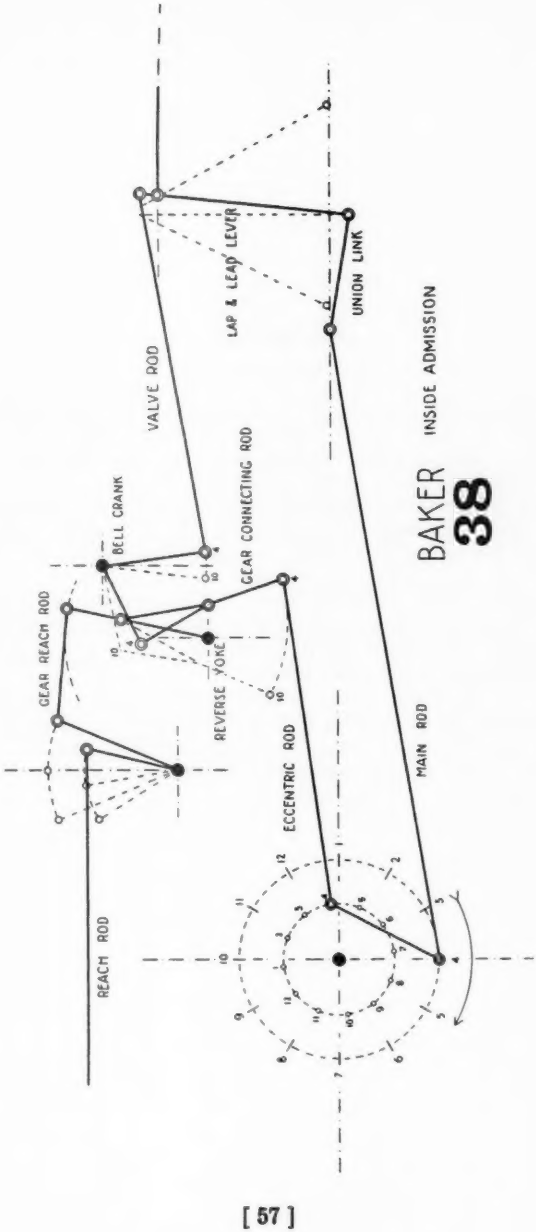
(Inside admission. Dwg. 38)

In the Walschaerts valve gear for outside admission, the eccentric pin is set approximately 90 degrees *in advance of* the main pin when in forward motion; and the lap and lead (or combination) lever is always *above* the radius rod connection. For inside admission the eccentric is set at 90 degrees *behind* the crank pin, and the valve stem connection is always *below* the radius rod connection to the lap and lead lever.

These placings of the eccentric pin and the valve stem connection to the lap and lead lever are mentioned because some writers on the Baker gear have called it a form of Walschaerts motion, which it very distinctly is not; unless the use of the return crank and crosshead-driven lap and lead lever bring it under that head.

As stated before, the motion of the Baker gear is on the Hackworth principle, the lap and lead lever being driven as in the Walschaerts motion. In the Baker gear the eccentric pin is *always* set 90 degrees behind the main pin (when running forward) for both outside and inside admission. Instead of changing the position of the eccentric pin in relation to the main pin, the position of the bell crank is altered; and the lap and lead lever connection to the valve rod and valve stem are altered as in the Walschaerts motion.

It may be mentioned in passing that, while both Baker and Walschaerts gears are of the constant lead type, they give slightly different valve positions at corresponding crank pin positions. If well laid out, there is little to choose between them. Judging from the number in use Walschaerts seems to be the favorite.


BAKER
38
INSIDE ADMISSION
VALVE ROD
LAP & LEAD LEVER
UNION LINK
BELL CRANK
GEAR CONNECTING ROD
GEAR REACH ROD
REVERSE YOKE
ECCENTRIC ROD
MAIN ROD
REACH ROD

MARSHALL

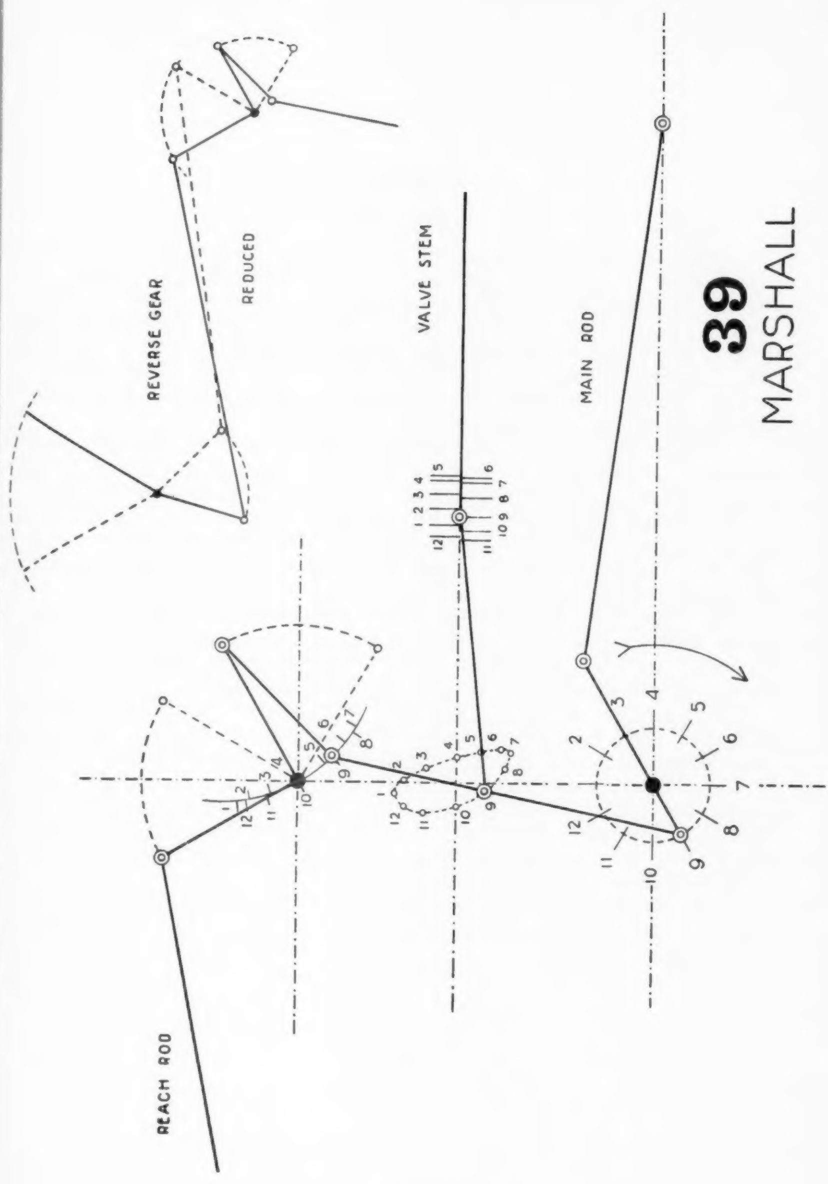
(Dwg. 39)

One of the several copies of Hackworth's motion is that of Marshall's, which came out in 1879. As in Hackworth's earlier motion, the eccentric rod was driven from a point opposite the main pin, and the valve rod from an intermediate point on the eccentric rod.

The only difference between Marshall's and the original Hackworth gear is that, in the former, the path of the top end of the eccentric rod travels in the arc of a circle whose radius is determined by the length of the link hung from the reverse arm.

This curved path, which replaces the one of the straight slotted link of the Hackworth gear, produces a slightly different shaped path at the back end of the valve rod than does the latter, consequently there is a slight difference in the valve events.

It may be mentioned that, in Hackworth's patent specification of 1859, one almost identical with that of Marshall's is pictured and described; so that the latter was, in all probability, one of the many infringements of his motion which caused Hackworth so much trouble.


REACH ROD
REVERSE GEAR
REDUCED
VALVE STEM
MAIN ROD
39
MARSHALL

STRONG I.

(Dwg. 40)

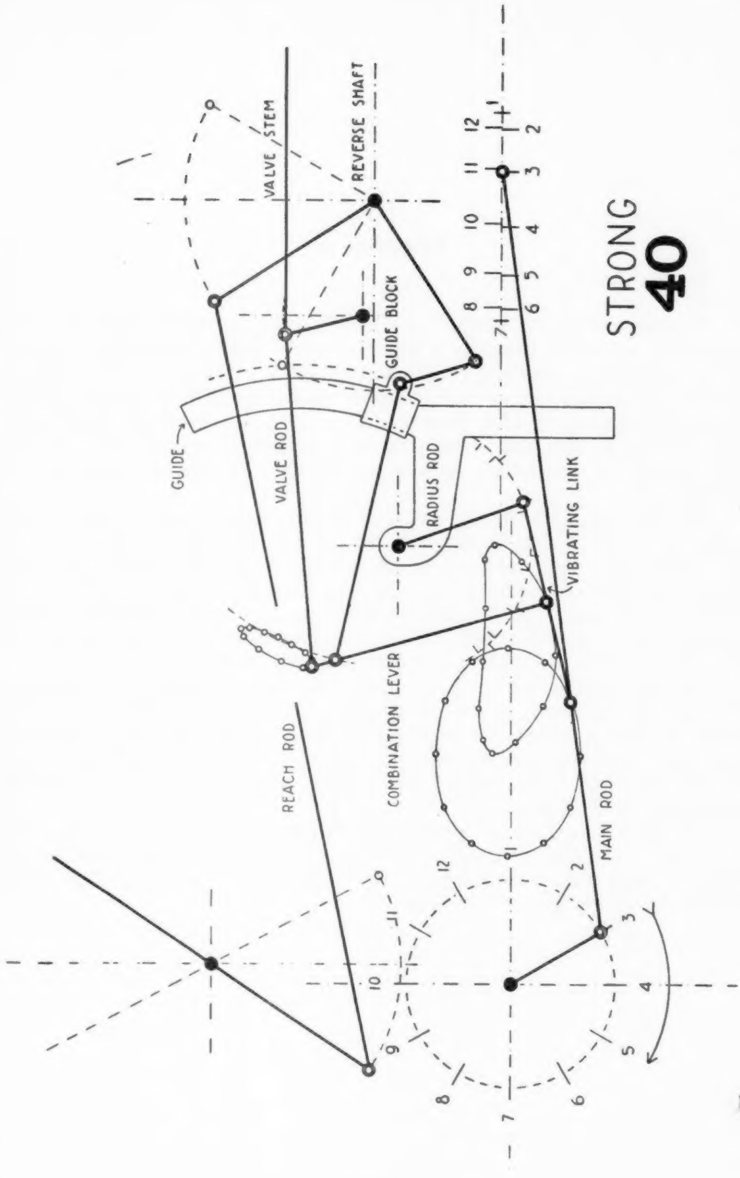
Of all the American engineers who attempted to improve the locomotive, one of the most persistent and persevering was George S. Strong, of Philadelphia. His efforts extended over a period of more than ten years, 1885 to 1896. Among the innovations included in his designs was a long boiler with twin corrugated furnaces and a combustion chamber. Strong adhered to this form of boiler in all his designs, and his obstinacy in retaining this feature had a good deal to do with his engines failing to achieve success.

Among other outstanding features incorporated in Strong's locomotives, of which several were built, was a valve gear employing an unusual motion and grid-iron valves. The one shown here was designed for the Lehigh Valley's No. 444, a powerful 4-6-2, built at the Wilkes-Barre shops in 1886. The same company's No. 383, an eight-wheeler with an ordinary boiler, had been fitted with Strong's valves during the previous year, and road tests had shown promising results.

Strong adopted a vertical grid-iron form of valve in all his designs. These worked very close to the cylinder walls, cutting clearances to the minimum. Various forms of motion, taken from main rod, eccentric, or return crank, were used to actuate these valves.

This motion, which was for No. 444, is based on the Hackworth principle, with a drive somewhat akin to that of Joy's. Here the resemblance ends, for Strong used a reverse and cutoff based on one of Chas. Brown's motions; a fixed curved guide with a sliding block taking the place of the swinging arm used by Hackworth, Brown, Marshall, Bremme and others. The grid valves are not shown here, though they were an essential part of Strong's valve gears, our interest being in motion rather than valves.

This motion was never applied to the 444, though shown in the original drawings of the engine; the simpler one, shown in the following design, taking its place.


VALVE STEM
REVERSE SHAFT
GUIDE BLOCK
GUIDE
VALVE ROD
RADIUS ROD
VIBRATING LINK
COMBINATION LEVER
REACH ROD
MAIN ROD
STRONG
40

STRONG II.

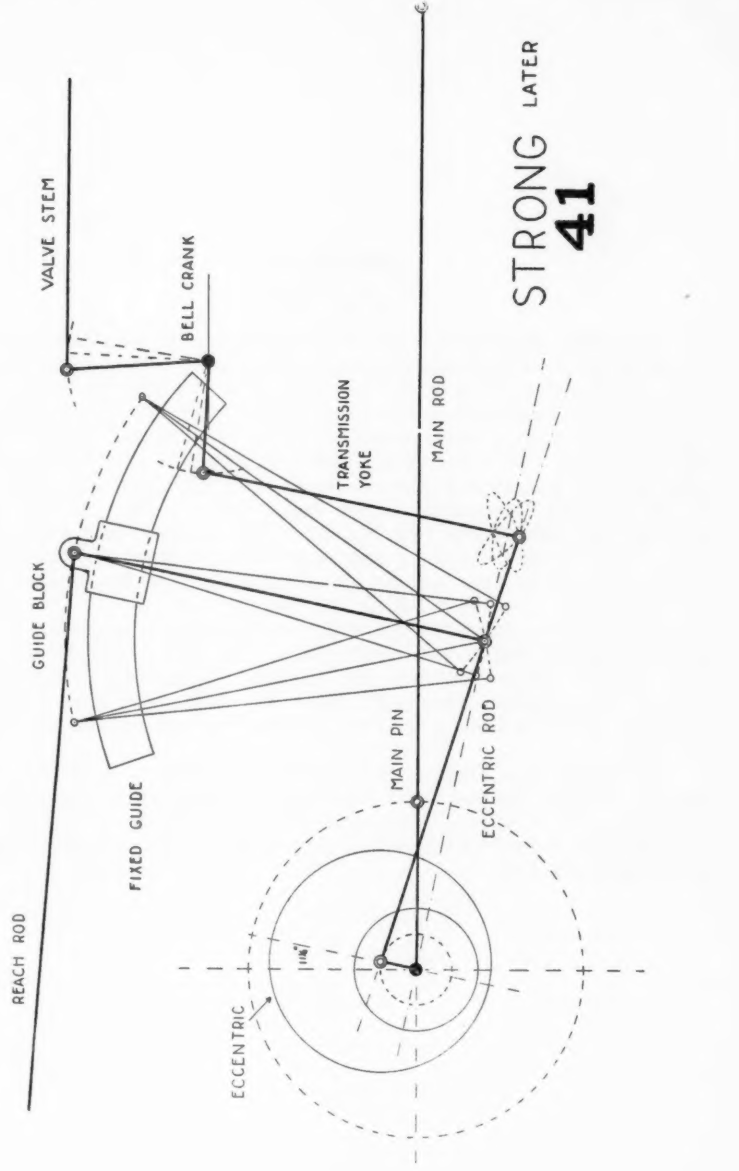
(Dwg. 41)

In this motion of Strong's we have something much simpler. The valve rod, or valve stem, is driven by a bell crank, necessary because of the horizontal position of the curved link. Were this link placed exactly horizontal, the eccentric center would be at right angles to the main pin, instead of 11¼ degrees off. As in all forms of Hackworth gear, of which this might be termed a Bremme variety, the lap and lead feature is dependent on the proportions of the two ends of the eccentric rod.

In this gear of Strong's the reversing guide, bell cranks, valve rods, etc., were arranged in pairs to drive vertically the four valves, one steam and one exhaust, at each end of the cylinder. Exhaust valves travelled full stroke, at whatever cut-off the steam valves were working. In this way full advantage was taken of expansion, while exhaust was late and rapid. Enough compression was allowed for, to properly cushion the inertia of reciprocating parts.

On the Lehigh Valley 4-6-2 engine the motion showed an economy of some 15 per cent, of which perhaps a large part was due to the double grid-iron valves. Nevertheless his valve gear was never regarded with any favor by the mechanical heads of American railroads, and can be considered only as an interesting diversion in the history of locomotive development.

Strong's last engines, which were balanced compounds of the 4-4-2 type, and very fast runners, were fitted with a modified Walschaerts motion. This was designed to operate steam and exhaust valves independently, as did the earlier types.


VALVE STEM
BELL CRANK
TRANSMISSION YOKE
MAIN ROD
GUIDE BLOCK
FIXED GUIDE
MAIN PIN
ECCENTRIC ROD
REACH ROD
ECCENTRIC
STRONG LATER
41

SOUTHERN

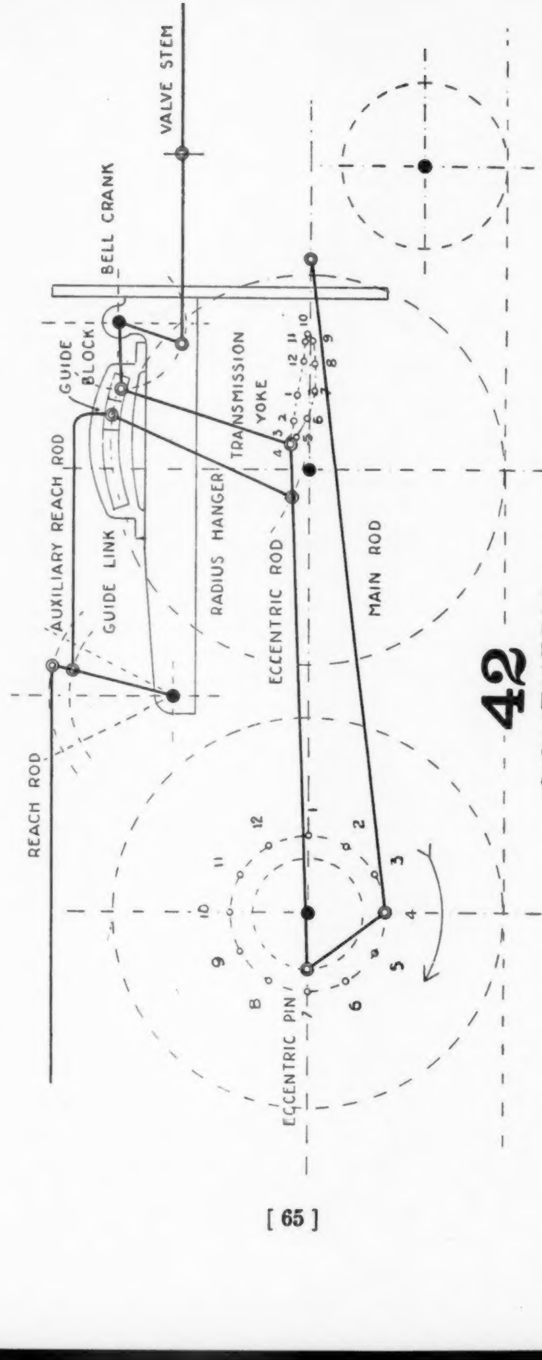
(Dwg. 42)

This gear, patented by Wm. S. Brown, in 1912, was first fitted to locomotives of the Southern Railway, where Brown was an engineer. It was used on other roads in the U. S. and in Mexico and Australia.

To many, the Southern was a new gear but, with the exception of its driving point being a return crank instead of an eccentric, it was a direct copy of Strong's second motion. Brown's method of outside connection made possible a straight-line drive, and an admirably simple motion, well adapted to the increasingly larger engines of the day. There being no working sliding parts (the link providing for reversing and cut-off only), and all bearings being pins and bushings, there is little opportunity for wear and lost motion. Another advantage; the reverse lever can be hooked up without taking the engineer with it.

The diagram shows the arrangement for outside admission. It can as easily be adapted to inside admission. The first engine to which it was applied was a Southern Ry. 22"x28" Consolidation with slide valves. As in other Hackworth gears the amount of lead, which is constant, is determined by the ratio between the two ends of the eccentric rod.

If Strong used Hackworth's motion on which to build his own, Brown certainly showed little hesitancy in following Strong's design to produce the Southern. Practically the only difference between the two, and that is a minor one, is that Brown used a return crank in place of Strong's eccentric.


VALVE STEM
BELL CRANK
GUIDE BLOCK
TRANSMISSION YOKE
AUXILIARY REACH ROD
GUIDE LINK
RADIUS HANGER
ECCENTRIC ROD
MAIN ROD
REACH ROD
ECCENTRIC PIN

42 SOUTHERN

LENTZ (Marshall)

(Dwg. 43)

Some of the finest locomotives in Continental Europe have been turned out by the Floridsdorf Works, at Wiener Neustadt, near Vienna. Among these were the large and high-wheeled 2-8-4 passenger engines of the Austrian Federal Railways, designed by Herr Lehner. The engines of this class, while otherwise identical, were of both two- and three-cylinder drive, the valves being of the Lentz oscillating cam type.

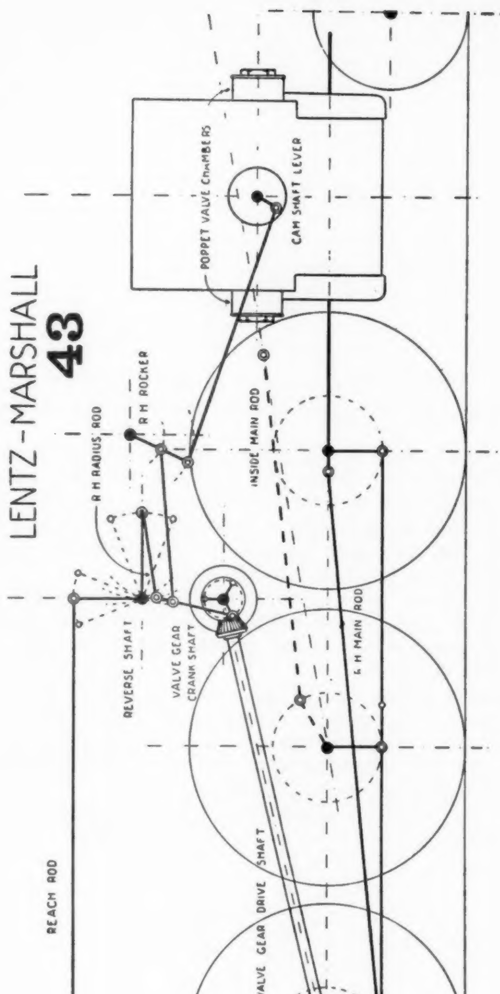
In the two-cylinder engines the cams were actuated by the conventional Walschaerts motion, while in the three-cylinder machines a Hackworth gear of the Marshall type was used.

As the essential features of this motion are rather small in the design shown it may be well to refer to plate No. 39, which shows the principle of the Marshall gear.

While it had not been intended to include other than slide- and piston-valve motions, this poppet valve gear was introduced as it shows an interesting application of the Hackworth principle.

In these three-cylinder engines the valves and chests are alike, and each valve is driven by its individual motion from the transverse three-crank valve gear shaft, which, in turn, is driven by a shaft bevel-geared to the third pair of drivers. The gearing is such that the valve gear crank shaft turns at the same speed as the driving axle. Positions of the three main pins and right side valve connection are shown.

The inside-cylinder drive is through a shorter main rod, connected to the second pair of drivers and is set at a sufficient slant to the horizontal to enable the connecting rod to clear the forward axle.


LENTZ-MARSHALL
43
POPPET VALVE CHAMBERS
CAM SHAFT LEVER
R H ROCKER
R H RADIUS ROD
INSIDE MAIN ROD
REVERSE SHAFT
VALVE GEAR
CRANK SHAFT
R H MAIN ROD
REACH ROD
VALVE GEAR DRIVE SHAFT
L H CRANK PIN

WILSON

(Dwg. 44)

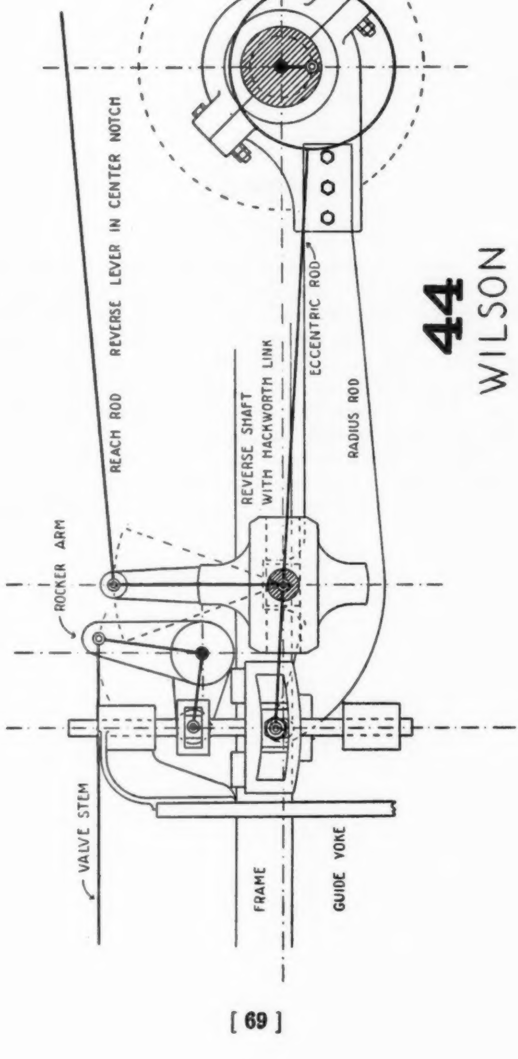
In 1885, William Wilson, Sup't of Motive Power of the Chicago & Alton, brought out a single eccentric valve motion of the Hackworth type.

In this gear a short straight link, with a sliding block, is integral with the reverse lever. When the latter is in the center notch, the link block travels back and forth horizontally, while the forward end of the eccentric rod describes the ellipse, characteristic of all Hackworth gears, to give lap and lead movement to the vertical rod. This rod drives the valve stem through a bell-crank.

When the reverse lever is moved away from the center, the straight reversing link is placed at an angle to the horizontal, and governs the direction and amount of valve travel. As with other Hackworth motions, lead is constant.

To eliminate errors due to the rise and fall of the engine frame relative to the driving axle, a deep arm or radius rod is hung from the frame, its forward end at the location of the vertical rod that drives the rocker, and with its back end bearing on the driving axle. Its function is to carry the reverse shaft.

Wilson tried hard to make a go of this motion but, like many another, it got nowhere.


REVERSE LEVER IN CENTER NOTCH
REACH ROD
ROCKER ARM
REVERSE SHAFT
WITH MACKWORTH LINK
ECCENTRIC ROD
RADIUS ROD
VALVE STEM
FRAME
GUIDE YOKE

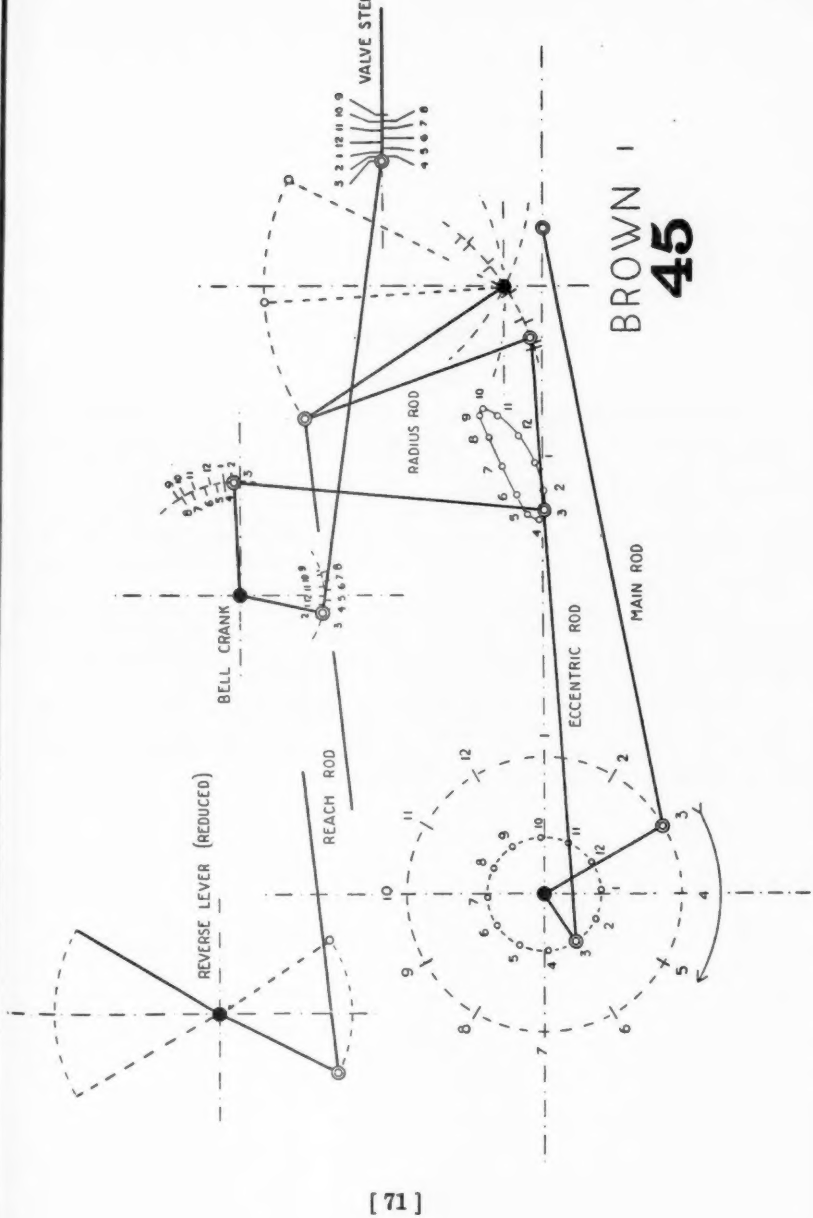
44
WILSON

BROWN I

(Dwg. 45)

One of the valve motions developed by Chas. Brown, of the Swiss Locomotive Works, was this modified Hackworth type, the drive being from a point on the eccentric rod, and connecting with the valve rod through a bell-crank. This necessitates placing the eccentric pin at right angles to the main pin. Essentially it is a Marshall gear with the eccentric at right angles to the crank, and the addition of a bell-crank. In later years (1903) Baker had this identical design patented and in use as the Baker Traction Engine Gear.

Brown's different motions were used on locomotives of many types, but for the greater part of the production of the Swiss Locomotive Works the Walschaert motion was the favorite, as it was indeed all over continental Europe.


VALVE STEM
RADIUS ROD
BELL CRANK
ECCENTRIC ROD
MAIN ROD
REACH ROD
REVERSE LEVER (REDUCED)
BROWN
45

BROWN II

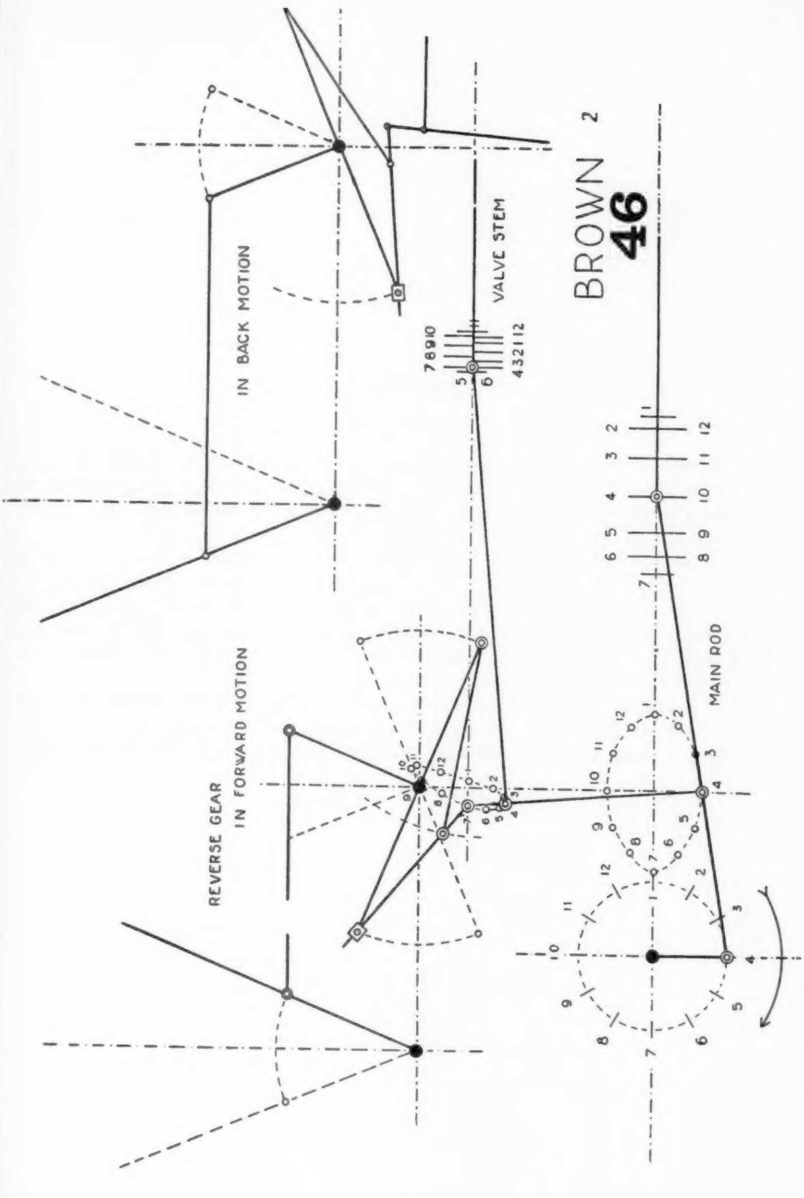
(Dwg. 46)

This interesting motion is one that has been applied to a number of small locomotives by the Swiss Locomotive Works, in the eighties and nineties of the last century. Although of the Hackworth type it has features peculiar to itself alone.

The drive is taken off a point on the main rod, as with Joy's, and the path of the back end of the valve rod is elliptical; but the top of the intermediate driving rod is given its curved path, an arc, in an entirely different manner.

In the Joy gear, correction is made by the use of an anchor rod and link connecting it with the main rod, while, in this variety of Brown motion, corrections are carried out by varying the proportions of the several arms of the mechanism centered at the reverse shaft.

That this motion may be more readily understood, it may be well to state that the elements connecting with the top of the intermediate rod (the driving rod to which the valve rod is attached) has a sliding motion in the block at the end of the back reverse arm.


REVERSE GEAR
IN FORWARD MOTION
IN BACK MOTION
VALVE STEM
MAIN ROD
BROWN 2
46

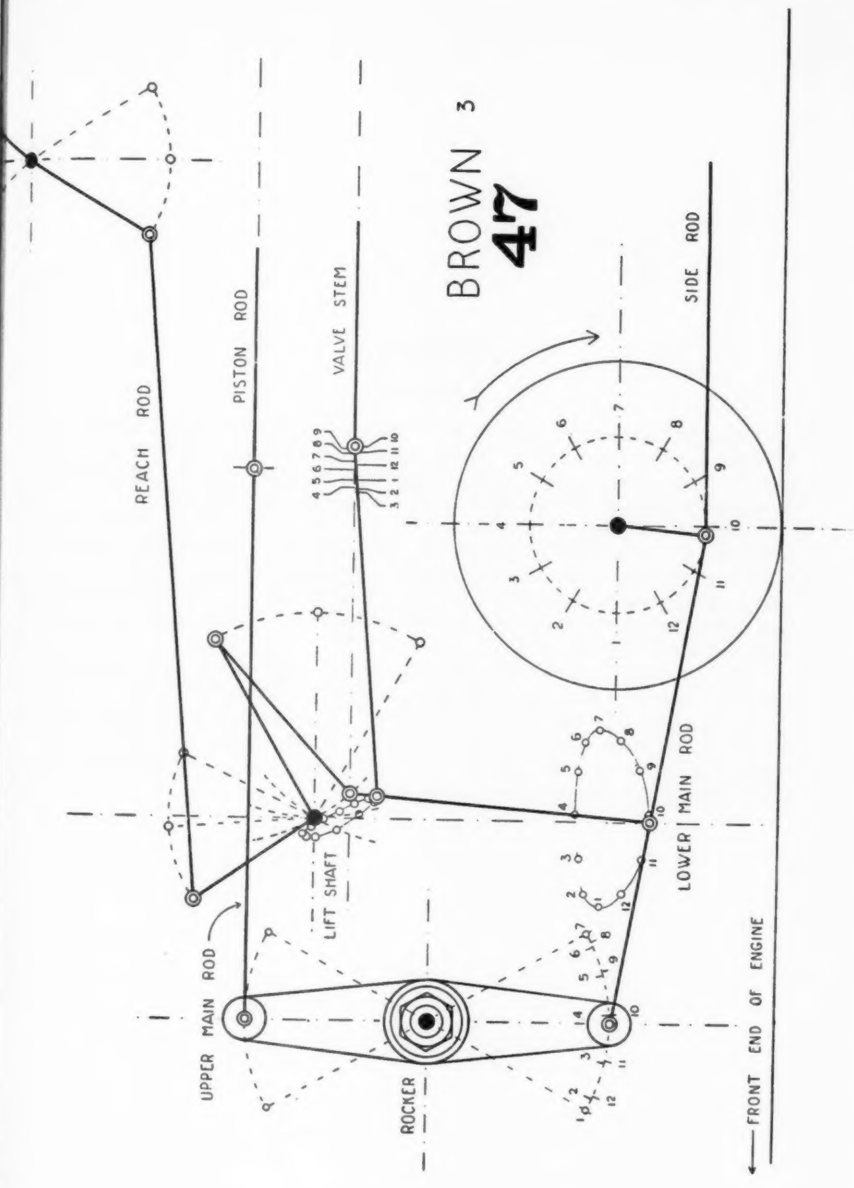
BROWN III

(Dwg. 47)

Another type of Brown motion, and a simpler one, is shown here. In this, the often-used swinging guiding link one sees in Hackworth motions is attached to the outer end of the lift- or reversing-arm. Drive is from the main rod instead of from an eccentric.

This arrangement has been much used in small locomotives built by the Swiss company. In the design shown, power from the cross-head is transmitted to the wheels by upper and lower main rods through a rocker at the front end of the engine. The cylinders are placed back on, and well above, the main frames, and the steam chests are beneath the cylinders. Engine is shown in back motion.

A number of small contractor's locomotives with motion of this type were used by the old French company in the construction of the Panama Canal, and were still on the job after the U. S. Gov't took over.


REACH ROD
PISTON ROD
VALVE STEM
BROWN 3
47
SIDE ROD
LIFT SHAFT
UPPER MAIN ROD
LOWER MAIN ROD
ROCKER
FRONT END OF ENGINE

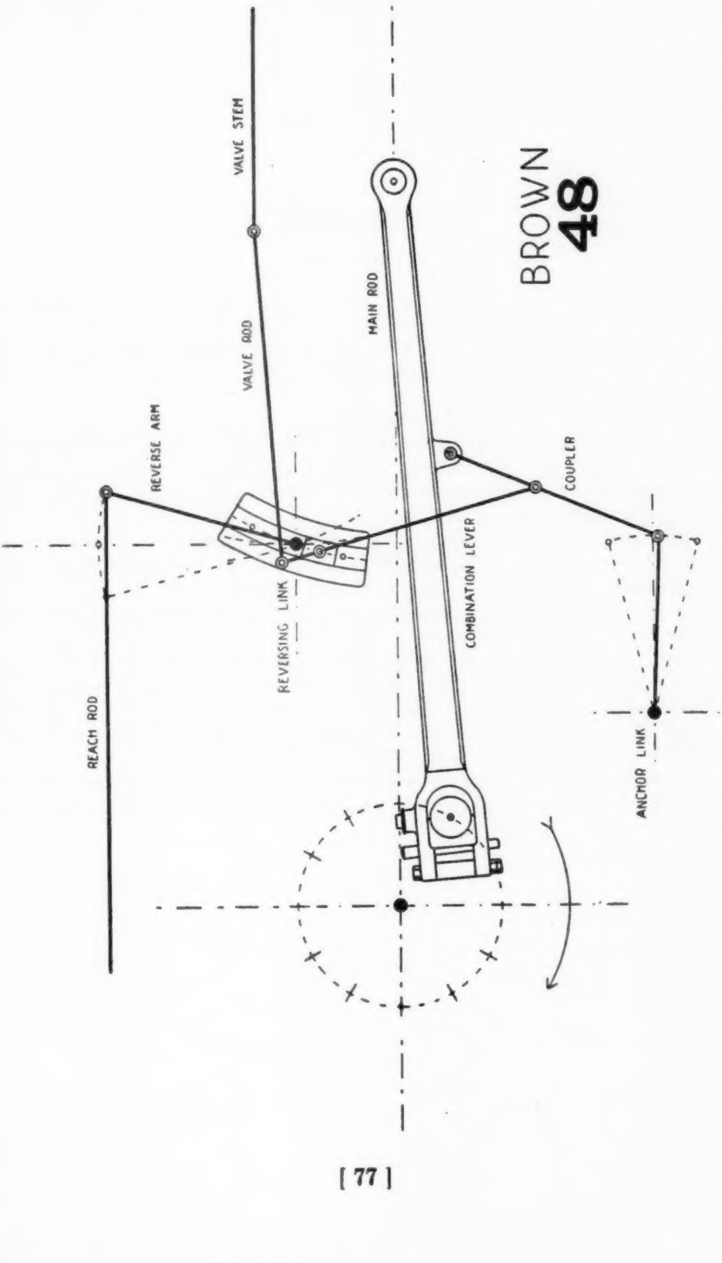
BROWN (Joy)

(Dwg. 48)

Another case of designers working independently and arriving at, or near to, the same result, is the motion here shown. It was worked out by Chas. Brown, the eminent engineer of the Swiss Locomotive & Machine Works, at Winterthur, in the seventies and eighties.

Brown designed a number of valve motions, some of which were based on the Hackworth principle. The one here shown was worked out about the time that Joy, the English engineer, introduced his famous valve motion and, excepting for one small detail, the short correcting arm extending down from about the middle of the main rod, it is almost identical with Joy's.

The design from which the illustration was made was probably not for locomotive service, as the anchor link would come too close to the track with any but the largest of drivers. This anchor link pivots just ahead of the main drivers, whereas in Joy's motion the connection was usually made at or near the back cylinder head. In other respects the gears were almost identical in their action.


BROWN
48
VALVE STEM
VALVE ROD
MAIN ROD
REVERSE ARM
COUPLER
COMBINATION LEVER
REVERSING LINK
REACH ROD
ANCHOR LINK

JOY-WALSCHAERTS

(Dwg. 49)

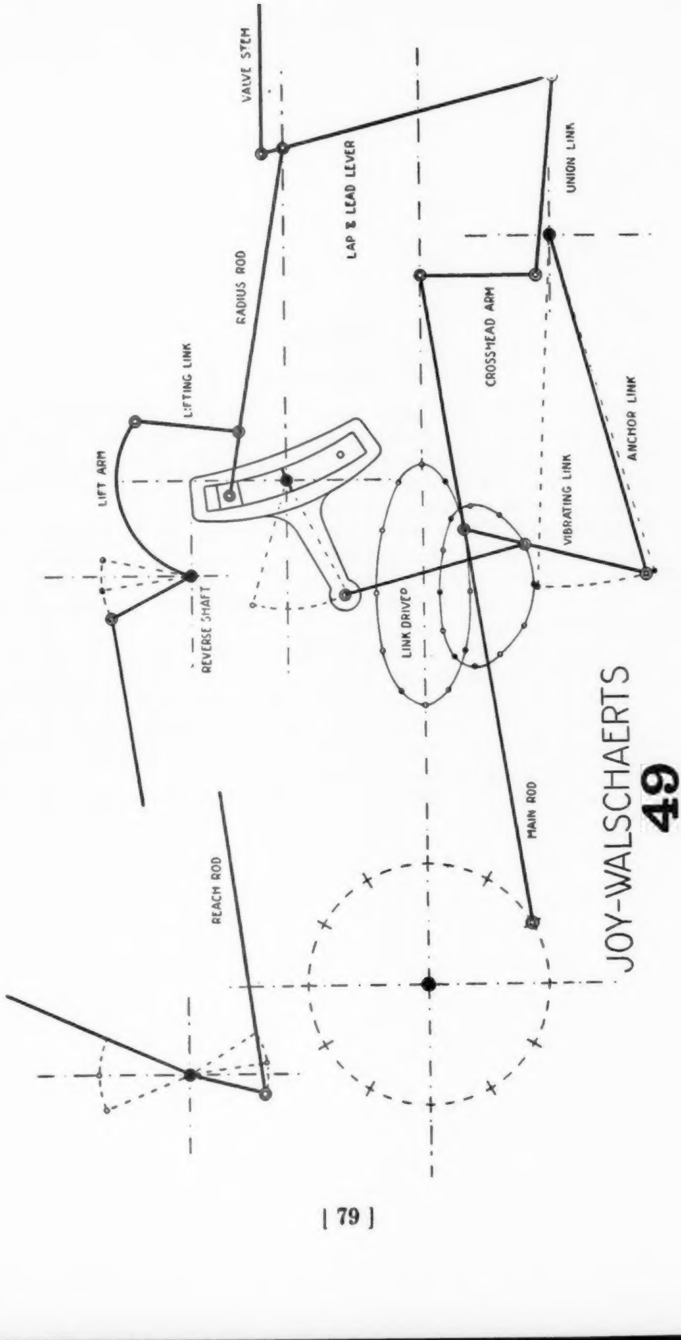
This combination, which was tried out on the Western Railway of France, is a Walschaerts gear with the eccentric crank and rod replaced by the conventional Joy drive coupled to a horizontal arm on the link. The lap and lead lever is of the usual Walschaert type worked from the cross-head arm.

The diagram shown was made from a description of this gear, which was applied to some 4-4-0 locomotives in the early nineties, and shows the principle involved. As drawn, it is arranged for outside admission valves, and shows the reverse lever in full forward position and the link block at the upper end of the link.

While the Joy correcting gear may have shown an improved distribution of steam in the cylinders, it is obvious that the whole loses much in simplicity as compared with ordinary Walschaerts motion using a return crank and single eccentric rod; and it is easy to understand why its use was not perpetuated.

The point-paths of the main rod connection and the lower end of the link-driver are clearly shown, and can be carried out on the link arm arc, and thence through the link block, in connection with the lap and lever movement, to the valve-stem connection. This will give the valve position at any point of the piston stroke.

This motion is subject to slight errors due to the rise and fall of the engine frame on its springs, a failing common to other gears of the Joy type.



JOY-WALSCHAERTS
49

SISSONS

(Dwg. 63)

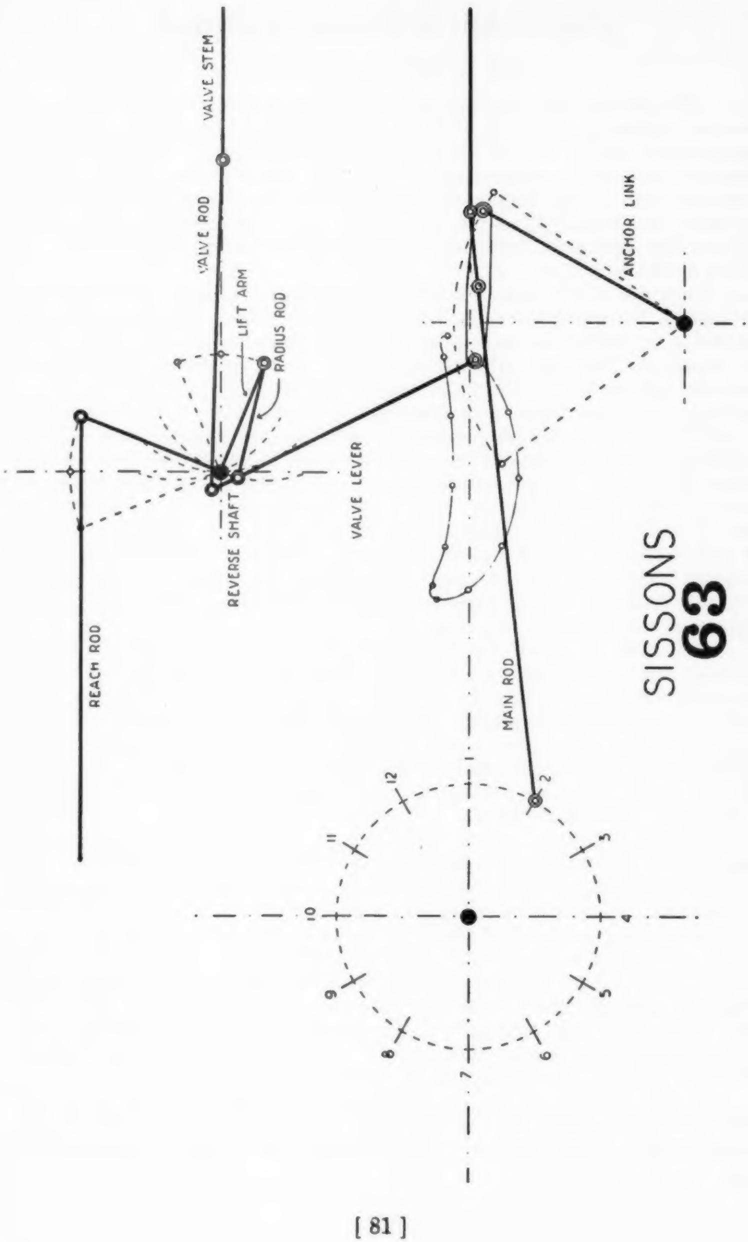
Another of the valve gears based on the Hackworth principle, the Sissons has features that make it very like the Joy. The drive is off the main rod, in fact almost at its forward end, while, instead of the Joy linkage, there is a swinging link fulcrumed on it. The forward end of this link, or lever, is connected to an anchor link.

The back end of this moving lever actuates the valve lever, whose fulcrum is at the end of the radius rod. The radius rod describes any of the three curves shown (dotted lines), depending on whether the reverse lever is in full forward, neutral, or full back position; or other arcs giving less travel if hooked up.

The upper end of the valve lever, to which the valve rod is connected, describes the characteristic Hackworth closed curve or ellipse.

The valve lever might be called a lap and lead, or combination, lever; however it is more than that, for its swinging motion gives the valve its lead, and its up-and-down motion port opening. Lead, as with Hackworth's motions, is constant.

The Sissons motion came out in 1885, some six years after Joy's invention.


VALVE STEM
VALVE ROD
LIFT ARM
RADIUS ROD
REVERSE SHAFT
VALVE LEVER
REACH ROD
ANCHOR LINK
MAIN ROD
SISSONS
63
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The Mason & Oceana Railroad

BY ROBERT W. GARASHA

"The generation that subdued the wildland and broke up the virgin prairie is passing, but it is still there, a group of rugged figures in the background which inspire respect, compel admiration. With these old men and women the attainment of material prosperity was a moral victory, because it was wrung from hard conditions, was the result of a struggle that tested character. They can look over those broad stretches of fertility and say: 'We made this, with our backs and hands.'"—Willa Cather.

The story of the Mason & Oceana Railroad begins in 1874, with the arrival of Horace Butters in Ludington, Michigan. Butters was born in Maine in 1833. At the age of 19 he left home and went to Manistee to engage in logging. Twenty-two years spent in Manistee were not only enough for him to learn thoroughly the involved business of logging, but they also convinced him that his real opportunities lay elsewhere.

Early in 1878, Horace Butters entered into partnership with Richard G. Peters, forming Butters, Peters & Co.; to be known within a short time as the Butters & Peters Salt & Lumber Co. Peters was born in Delaware County, New York, July 2, 1832. He left his farm home at 18 and started for Cincinnati, Ohio. From there he came to Michigan, landed at Point Sauble in 1858, and went to work for Charles Mears, one of the pioneer lumbermen of the area. From there he went to Ludington to oversee the lumbering interests of James Ludington, where he became associated with Horace Butters.

It is almost impossible for the present-day traveler to envision Michigan as it must have appeared in those days. Dense, heavy, almost impassible growths of oak, spruce, pine, cedar, tamarack and many other trees covered the rolling hills. The virgin forest stood untouched, as it had for hundreds of years before. Deer and bear were to be found everywhere, and other forms of game were equally plentiful. This magnificent wilderness represented untold wealth, for those who were bold enough to step in and take it.

Butters & Peters rose to the challenge of the trees, buying several large tracts of pine land in Sherman and Branch Townships in the Fall of 1878. By Spring of the following year logging operations had begun in earnest. A camp was established on the north branch of the Pere Marquette River, somewhat south of the town of Valhalla. A three-foot gauge railroad was installed to bring logs from the forest to the river bank. Very little is known of this early rail operation. Home-made logging cars were used, with geared engines, probably Lima Shays, to pull them. Rail was extremely light, not more than 20 lbs. to the yard. It is certain, though, that this early rail equipment formed the nucleus of what later became the Mason & Oceana Railroad.

At the bank of the river a log dump was built. The banks of the Pere Marquette are as high as 100 feet in this vicinity, hence this became known as the "High Dump." Traces of the heavy timber construction may still be seen.

Logs were floated down the river to Pere Marquette Lake, at Ludington. By the time Butters & Peters had arrived on the scene, Ludington had already become a port of importance, so that the cost of land for establishing a sawmill on the Ludington side of the lake would have been prohibitive. Hence, by 1880, the firm had purchased land at the base of the point which separated Pere Marquette Lake from Lake Michigan. Also, by 1880, a saw mill and shingle factory were built.

This sandy point did not, perhaps, furnish an ideal location for homes, exposed as it was to the winter rigors of Lake Michigan. But a settlement soon sprang up, and became known as Buttersville. Actually there were four towns, closely allied; Buttersville, Taylorsville, Seatonville, and Finn Town; going in that order northward from the base of the point. The connecting link between these localities was a long plank road, generally called the "Maple Plank Road." This means of communication extended the entire length of the sandy peninsula. Naturally, the inhabitants of the towns were employees of the Butters & Peters Co., or of the other logging firms which established mills in the vicinity.

From the very start of operations, a huge volume of timber was cut. Trees were slashed and destroyed, with no thought for the future, no concern for reforestation. It was as if a horrible, leveling plague were passing over the land, taking all that was living, and leaving nothing but barrenness in return. But this was the custom, to have thought otherwise would have been heresy.

The Butters & Peters Co. prospered and expanded. They began to handle logging for other firms, under contract. As they moved farther into the woods, away from the river, and as the volume of timber to be moved continually increased, it began to be apparent that the river was no longer a satisfactory means of transportation. Then too, other companies were using the river for their logs, and the chances of mixups in the ownership of the floating log booms were continually increasing. So the narrow-gauge logging railroad was extended through the woods, roughly parallel to the river, to the town of Buttersville. The camp was moved to the south branch of the river. This meant a real expansion in rail operations. The construction task itself was a heavy one, for the entrance into Buttersville was difficult. A trestle over one hundred feet long had to be constructed, and an extremely sharp curve was necessary in rounding the section of the Lake known as "Squaw Bay." This curve was so sharp that in later years, when rod engines were operated, much difficulty was experienced with their blind drivers dropping between the rails.

The first fatal accident on the line occurred Sept. 22, 1885. During high winds, a tree was blown down, striking the cab of an engine. A large limb was driven through the body of the engineer, Joshua Powers, killing him almost instantly and knocking him from the cab. A 'Doc' Fisher and one other person were in the cab at the time, and were also knocked off, receiving minor injuries. The accident occurred in the Township of Crystal. Powers was living at Custer and left a wife and five children.

The exhaustion of the timber along the Pere Marquette River was becoming a possibility. If logging operations were to continue, it would

be necessary to travel farther afield. This meant extending the railroad, and it also meant that it would be necessary to cross much private and state-owned land. So, a charter as a common carrier would be a decided convenience. The Butters & Peters logging railroad was incorporated on August 9, 1886. Its charter from the state named it the Mason & Oceana Railroad, and specified that its route would be from Butters & Peters Mill to Section 36, Township 16N, 16W. Officers of the company were Horace Butters, President; R. G. Peters, Vice-President; Marshall F. Butters, Secretary; and Martin McDermott, General Superintendent. (Marshall F. Butters was Horace Butters' son). Directors were R. G. Peters, Horace Butters, Marshall F. Butters, Robert Arnott, and Patrick O'Connor. $150,000 worth of stock was issued to seven stockholders, in shares of $100 each.

With this obstacle to further expansion removed, construction progressed rapidly. The line was extended southward through Mason County, and by January 6, 1887 the road was opened from Buttersville to Crystal Valley, a distance of 21.28 miles. The line did not actually enter Crystal Valley, which was some three miles to the west, and this station which served Crystal Valley later became known as Peachville. There were two wooden trestles on this part of the line, each over one hundred feet in length. One was over the south branch of the Pere Marquette River, and the other crossed the Pentwater River.

The cost of construction during 1887 amounted to $136,554.85. Other equipment, including rolling stock, required $32,664.70. Fencing was $2,185, real estate $741.78, and right-of-way $5,871.17, making the cost per mile $7,952.04. In addition to the main line, there were seven miles of sidings and logging spurs, giving a total mileage of 28.28 miles.

The rolling stock consisted of 4 locomotives, 1 passenger car, 1 box car, 24 flat cars, 80 logging cars, 2 camp cars, and 1 snow plow. Only one engine had a steam power brake, all the rest of the equipment having only hand brakes. With the possible exception of the passenger coach, all of this equipment was a legacy from the earlier logging railroad.

There were three stations, and 31 employees. No less than seventeen miles of telephone had been installed, which probably marks this as a very early example of the use of the telephone for regulating train movements.

In spite of the rather primitive nature of the railroad, it did quite well. 50,437 tons of freight were hauled, earning $28,283.39. Passenger earnings were $329.82, with 802 passengers carried. The only reported accident for the year (1887) occurred on August 19, when James H. Carr, a brakeman from Mason County, was killed. A car fell on him.

The coming of the railroad to Mason and Oceana Counties must have occasioned considerable popular interest. Oscar Wilson of Paul Bunyan fame tells this story:

"The time they were putting in the M & O Railroad, they were in a hurry to get the tracks laid down, but they were delayed because they couldn't get enough railroad ties. Not knowing what to do, they brought their troubles to Ol' Paul Bunyan, who was living at Stearns' Siding at the time.

"Paul was a real woodsman, and knew what to do immediately. He summoned twenty of his best lumberjacks, big fellers they were too, and had them each tie a fifty pound broad axe to the bottom of their feet, just like they were roller skates.

"Well, sir, he then sent 'em up to climb the trees, which they accordingly did. These big fellers in going up would make a cut every eight feet in the trunk, when they sunk the axe that was attached to their feet into the tree. When they reached the top, Paul shouted up and told 'em to turn their feet edgewise, and then slide down. They came down those trees like greased lightning. I never saw anything so fast, except, of course, the time Paul ran to Pentwater and back in a minute and a half. Yes sir, and you can believe it or not, but in coming down each of those fellows hewed both sides of the tree at once, and thus cut a tie off at every eight feet!

"Well, in about half 'n hour, there was enough railway ties left laying around to build two Mason & Oceana railways, and sufficient material to lay the bed of the Ludington-Baldwin route."

On January 20, 1888 service was opened from Buttersville to Stetson, 27 miles. Stetson was actually the name of a postoffice located south of the present town, and the station which was originally called Stetson, later became Walkerville.

By 1888, the company facilities at Buttersville had been much improved and expanded. In addition to the original shingle factory and saw mill, there was a cooper shop, a salt block, at least three salt or brine wells, a coal dock, a log dump, a warehouse, a depot, a three-stall enginehouse with turntable, and a machine and repair shop which accommodated two railway tracks.

The town of Buttersville, and its three neighbors had become bustling communities. They boasted a combined population of about 1900 inhabitants. There was a Methodist church, a school, and a ball park and pavilion. The company boat, "The Sprite," provided frequent ferry service across Pere Marquette Lake to Ludington. Lake-going boats were able to moor at the company docks during the summer, making the shipment of lumber from the mill convenient.

During 1888, Robert Arnott was replaced on the Board of Directors by William H. Butters, another son of Horace Butters. The extension to Walkerville had cost $10,258.67. There were other improvements to the railroad property, as well. One new locomotive was purchased at a cost of $4500. Scales were installed at Buttersville. The telephone line was extended to 27 miles. An express and baggage car was added, probably a converted box car. There was 1 new box car, 21 additional flats, another snow plow, and 7 hand cars. Three locomotives were now equipped with power brakes.

A mail contract was negotiated that year, bringing earnings of $500.45. The number of passengers soared to 9,430, bringing in revenue of $4715.39. 63,307 tons of freight moved over the line, and the total income from all sources was $37,446.27. Not bad for a baby railroad in the "wilderness" of Michigan!

There were now six stations and eleven highway crossings at grade, none protected with gates or flagmen. There were 40 employees. Naturally, the greatest part of the traffic carried consisted of lumber and forest products, but in addition to this the M & O was now handling grain, flour, provisions, animals, coal, plaster, lime and cement, salt, petroleum, stone, brick and sand, and general merchandise. It had become a genuine utility to the communities which it served.

There were a few sour notes in this happy picture. Accidents were alarmingly frequent, and while no one was killed during 1888, a great many were injured. Some of these injuries were due to carelessness, such as those of O. C. Hale, a Buttersville carpenter who, on April 18, jumped on a train while in motion and fell between the cars. But a great many of them were not. Trainmen were daily losing fingers with the dangerous link and pin couplers, for though the State of Michigan had passed an Act in 1887 requiring automatic couplers, very few railroads had done anything about installing them. The light rail was a hazard, too, and the company had been diligently replacing it with 25, 30 and some 35 lb. rail. Only a few years before, a rail had worked loose and pushed up through the coach floor, neatly impaling an Indian berry-picker, and spreading his innards over the soft scarlet upholstery of three seats.

Marshall F. Butters became president of the company in 1889, his father trading places with him to become secretary-treasurer. Passenger earnings went up over $5000, mail brought nearly $1000 and freight $33,651.84. Over 10,000 passengers were carried, and more than 70,000 tons of freight moved. Nineteen more flat cars were added. Miss Anna Bushaw of Fern, and Charles Larson, a brakeman from Crystal Township were killed on the line during 1889.

Business was booming. By 1890 Butters and Peters were shipping 20,000,000 feet of lumber, 40,000,000 shingles, and 175,000 barrels of salt every year. Including employees of the Mason & Oceana, they had about 400 men working for them. Their celebrated Vacuum Pan Dairy Salt was being shipped out in 1 to 28 pound wooden containers to food packers and processers all over the country. So heavy did this trade become, that it was necessary to build a salt warehouse at the tip of the point, for loading lake boats during the wintertime. The rails of the M & O were extended out to the warehouse, a team of horses often being used to move flat cars loaded with salt barrels. This extension also served the other mills which had been built—Pere Marquette, Seaton's, and Taylor's.

In spite of this prosperity, R. G. Peters saw fit to withdraw from the company. In July of 1886, he had become a member of the lumber firm of M. S. Tyson & Co. in Manistee, and had gradually developed other interests of his own in that vicinity. So, in 1890 Peters was replaced by George N. Stray as Vice-President. James Lyons became Secretary-Treasurer, marking Horace Butters' withdrawal as well.

Revenue from the mail contract increased to $1246.16. One light engine was added, bringing the roster to five. There were now 60 flat cars and 115 logging cars. There was also one caboose which had been built in the company shop.

Otto Wrege became chief engineer of the line in 1891, replacing Charles Crawford. This was somewhat of a banner year for the M & O, or the "Miserable & Ornery" as it had now come to be called by some of the less polite elements. Two additional engines were purchased at a cost of $8000. These were probably No. 5 and No. 7. The number of logging cars was increased to 175, employees to 50, and two more miles of logging spurs were added. 10,000 passengers and 80,000 tons of freight were carried in 1891.

1892 was uneventful, except for addition of another mile of logging trackage, and a drop of 20,000 tons in freight from the preceding year. Strictly speaking, the biggest rush of traffic was over now, and the freight tonnage was due to level off at a more or less constant figure for the remainder of the life of the line, never rising above 40,000 tons annually again.

On February 28, 1893, an accident occurred which was to have some important influence on railway-labor relationships in Michigan. There had been a heavy snow the night before, later freezing to a hard, slippery crust. It was decided to double-head the passenger train for Walkerville, but when it came time to leave it was discovered that there was no fireman for the second engine. A nineteen year old machinist's helper, George Yockey, was taken along as fireman.

A defective valve near the steps of the engine had not been repaired. The end of the pipe had been closed by driving a wooden stake into it. The extreme cold had caused the makeshift plug to leak, allowing a coating of ice to form on the step on the fireman's side.

The train made a stop to take on coal. When it started up again, Yockey attempted to swing back onto the engine. He slipped on the ice-coated step, the wheels of the tender passing over his right foot, severing the heel. As this happened, he was thrown clear of the train, only to slide back because of the icy coating on the snow banks along the track. As the trucks of the combine and coach passed, they repeatedly struck him in the head, inflicting numerous deep cuts, and tearing most of the skin from his face.

Because of the boiler protruding back into the cab, the engineer, Dave Taylor, was unable to see over to the fireman's side; consequently he was not aware that anything was wrong until the train had moved several miles down the line. Upon discovering that Yockey was not there, the train was stopped and backed down the line to search for him.

The unfortunate fireman, meanwhile, lay bleeding on the rails. Knowing that the crew would eventually miss him, and certain that they would back up to search for him, he dragged himself painfully a considerable distance to a logging camp, fearful that if he remained where he was he would be run over again.

The crew was able to follow the trail of blood on the snow, found him, and returned him to Buttersville, where he was treated at home. During the summer gangrene set in. In September Yockey's foot was removed, and eventually it was necessary to amputate his leg.

Yockey was anxious to bring suit against the railway, but he was restrained by his mother. The family had operated a shingle mill at

Lincoln, and they were close friends with both the Butters family and the other owners and directors of the railroad.

With but one day remaining of the legal limit, the case was brought into Circuit Court in Grand Rapids. A young, unknown attorney, Medor Louisell, represented Yockey. They lost the case.

Within a short time, however, they were back in court, with evidence that the railway officials had attempted to suppress evidence and influence the jury. Yockey was awarded a substantial settlement from the Mason & Oceana.

This was the first case of its kind ever decided in favor of the claimant in the State of Michigan. Not only did it set a precedent for other such cases, but it was also probably a strong factor in influencing the authorities to pass and enforce railway safety legislation within the succeeding years.

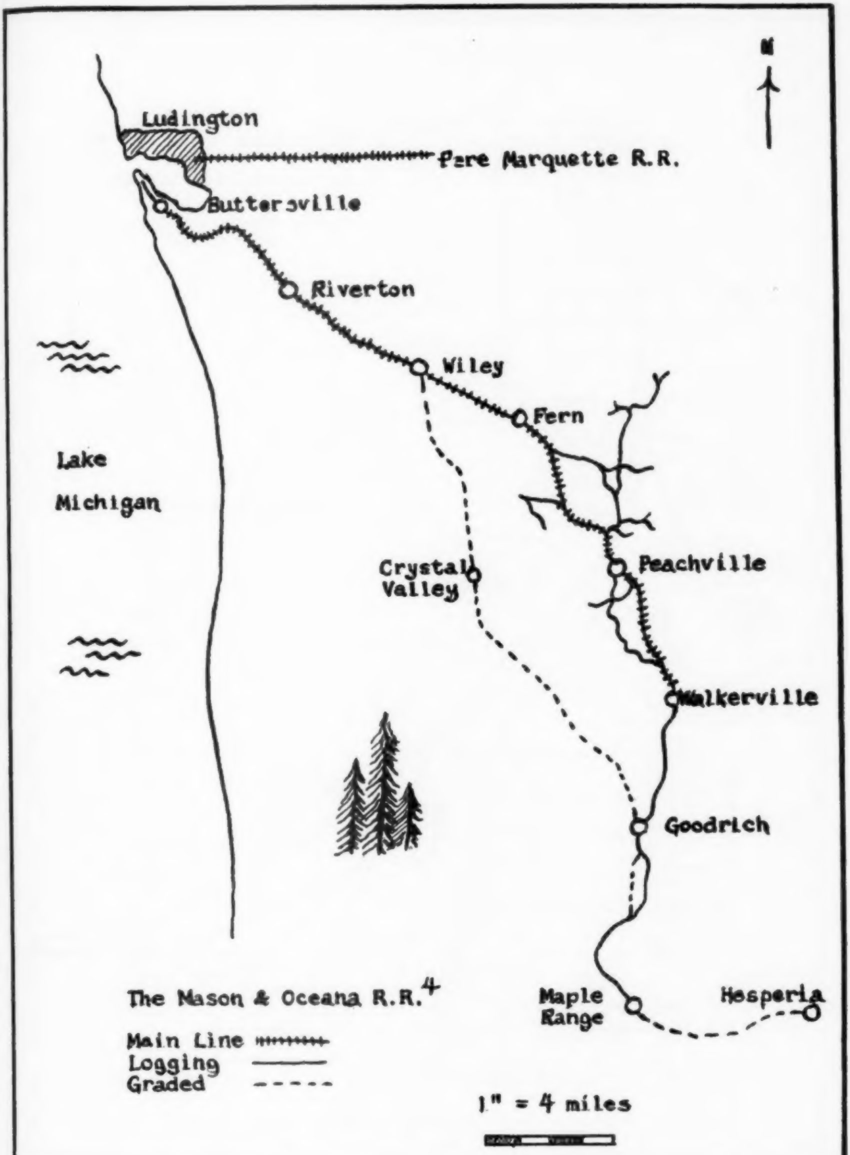
In spite of the accidents and other difficulties attendant upon winter operation, the railroad continued to provide service the year round, when possible. Sometimes it was not possible. February 26, 1895 saw the train blocked in snow at Walkerville, where it remained for five days. Telephone wires were broken by the accumulated snow. The trainmen carried the mail pouches on their shoulders, walking through the snow all the way to Buttersville.

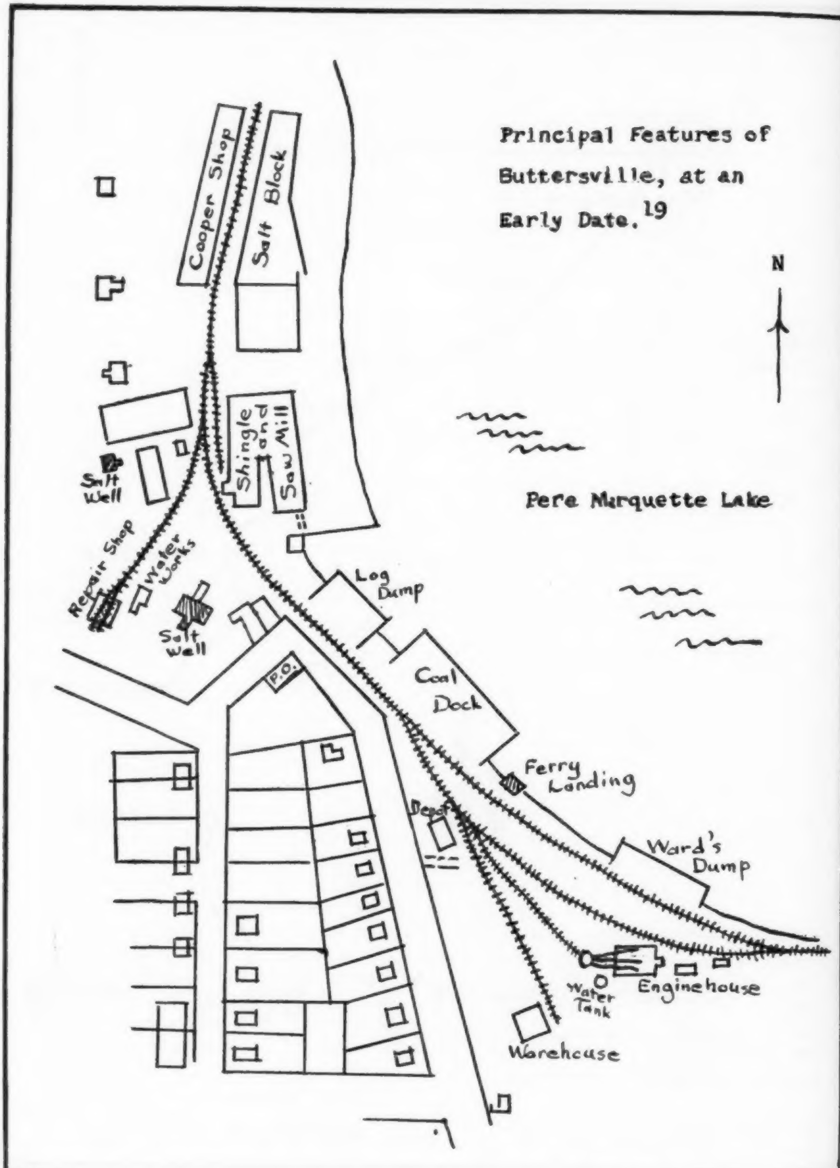
The M & O was doing its best to operate efficiently in other ways, too. In loading logs, a "jammer," or steam loader, was the accepted piece of machinery. It had an upright boiler, a boom, and cables which were used in loading the logs onto the railway cars. It was satisfactory as long as it was used in a fixed location, but was inconvenient to move at frequent intervals, as was necessary when the lumberjack crews moved from stand to stand of timber.

Horace Butters invented the "skidder" to take over the work of the "jammer." Essentially it consisted of a small boiler and series of steam winches, with steel cables which could be guyed to nearby trees. A traveling carriage was used to suspend pulleys from the main cable rig to load the logs. The complete assembly was mounted on four steel rails curved like sleighs at the ends, and greased so that it was possible to move along over the tops of the log cars. By various combinations of cable rigging to the nearby trees, a highly flexible means of loading and shifting log cars was obtained. Horace Butters' invention was later taken over by the Ledgerwood people and improved by the addition of an upright steel mast, so that it was not necessary to use trees for the inner point of support for the cable rigging.

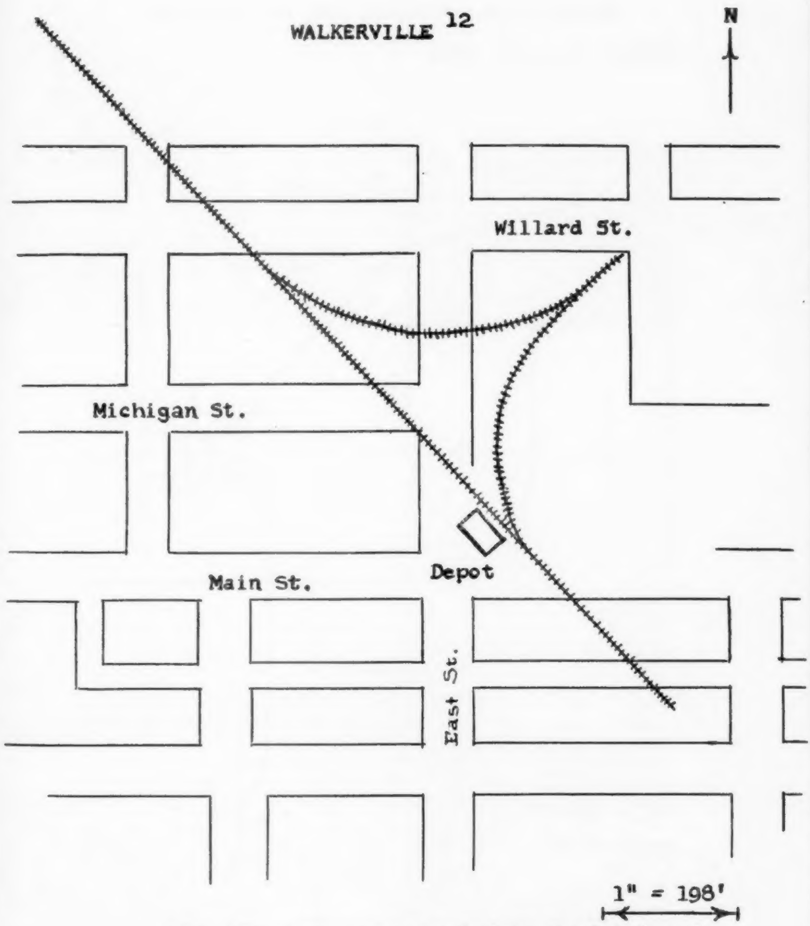
During the 90s a large coal dock was installed at Buttersville. This had dual-gauge trackage so that standard gauge cars could be emptied on it. Dual-gauge tracks were laid on a scow so that four standard gauge cars at a time could be brought over from slips in Ludington. These slips were located at the Stearns' yard and at the Pere Marquette docks, otherwise known as "Misery Bay." The standard gauge trackage at Buttersville was eventually extended so that it reached all of the lumber mills on the peninsula.

In 1898 a new source of traffic developed. For some time a produce market had been growing at Walkerville, in competition with the one


N
Ludington
Pere Marquette R.R.
Buttersville
Riverton
Wiley
Fern
Lake
Michigan
Crystal
Valley
Peachville
Walkerville
Goodrich
Maple
Range
Hesperia
The Mason & Oceana R.R.[4]
Main Line
Logging
Graded
1" = 4 miles

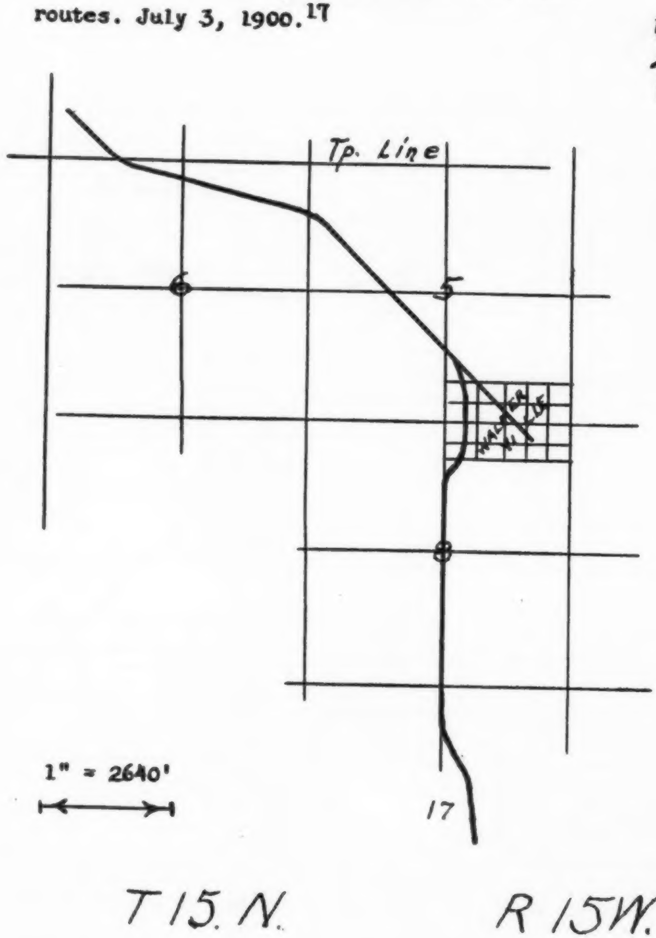


Principal Features of Buttersville, at an Early Date.[19]



When the line was extended to Goodrich and Maple Range, this trackage was removed and the depot moved to the west side of town.

Walkerville, showing old and proposed routes. July 3, 1900.[17]



Courtesy of J. A. Tarbell

The "Robert H. Butters" and train, just south of station at Buttersville. Engine shed leads in foreground.

Courtesy of H. J. Hansen

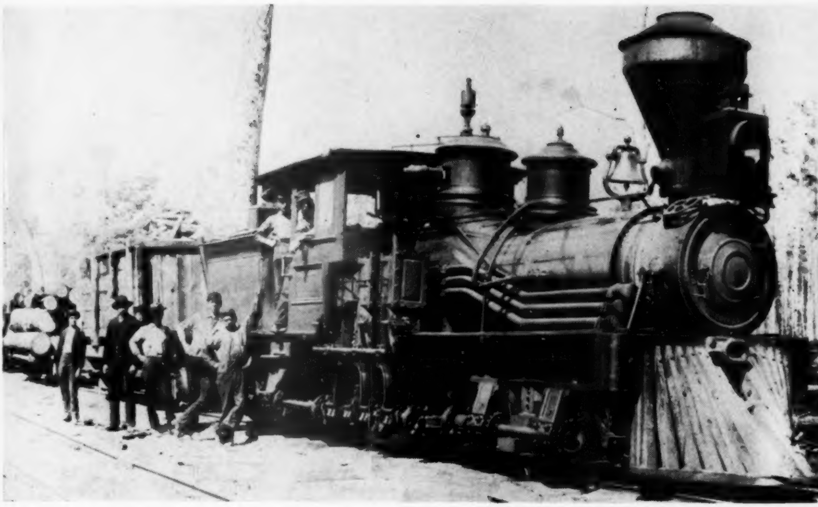
The Butters & Peters sawmill, looking across the log dump from the coal dock. The first "Dinky" is behind the waste pile at the left.

Courtesy of H. J. Hansen

Feed for the "hay-burners" was brought in over the narrow gauge.

Courtesy of H. J. Hansen

Loading logs. "This is (was) the forest primeval —"



Courtesy of C. C. Buskirk

The #2 ready for a day's work in 1902. "Dave" Richardson and Victor Carlson are in the cab; the tall man is Fred Nelson and Jack Hurley is at his left.

Courtesy of H. J. Hansen

Pere Marquette "C" becomes the 3rd #2 upon her arrival.

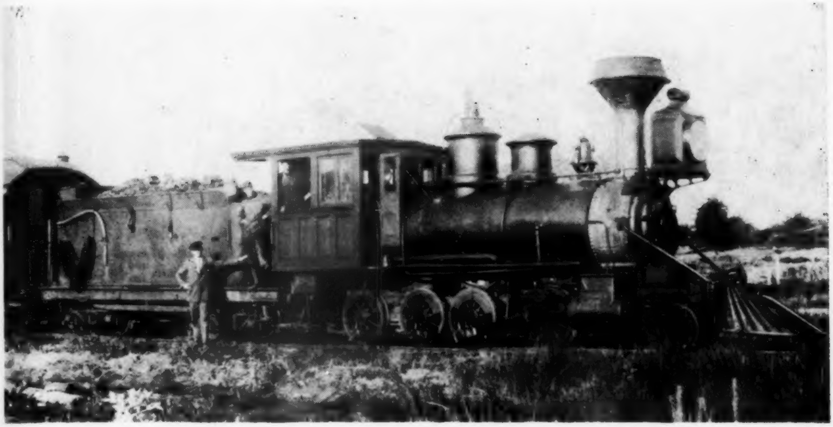
Loa
car

Courtesy of Bert Gerard

Loading logs on one of the branches near Peachville. Note the "jammer" or "skidder" cable attached to first car and the long "rooster" coupling. The barrels contain water for fire protection.

Courtesy of H. J. Hansen

A log dump on the Pere Marquette River. The engine may be the first "Dinky."



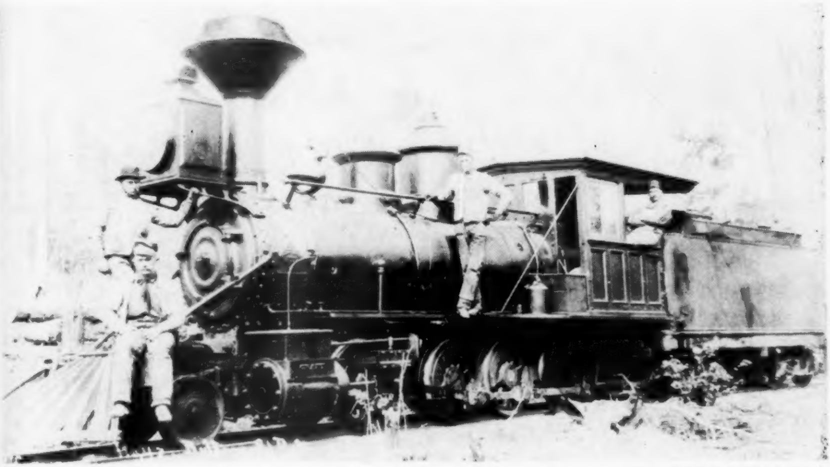
Courtesy of C. C. Buskirk

The #5 near Walkersville in 1892. Left to right: Homer Merrifield, George Patterson, Fred Nelson.

Courtesy of H. J. Hansen

The "Marshall F. Butters" with a load of lumber at Ludington in 1890.

The



Courtesy of Joseph Lavelle

The #7 and crew. Left to right: Obediah Mummey (standing), Joseph Amstutz, Fred Nelson, Guy Dagree.

Courtesy of H. J. Hansen

The Second "Dinky" brings her share of the logs to market.

The "Dinky" with the deer antlers on her head light and the #2 near Buttersville. Fred Nelson standing on the pilot of the #2.

at Hart, farther west and served by the Pere Marquette. Produce buyers from Milwaukee suggested that the M & O might be used to better the running time of the P. M. Four more box cars were built in the company shops to handle the traffic. Produce would be loaded at Walkerville in the evening and shipped to Buttersville. There the box cars would be run onto the scow already mentioned in connection with the coal dock, and brought alongside the "Black Boats," or Pere Marquette car ferries. The entire train crew would pitch in and transfer the produce from the narrow gauge cars to the boats. Running time from Ludington to Milwaukee was overnight, making possible delivery to the Milwaukee stores the following morning. Five additional box cars were built the following year to haul this traffic. The arrangement worked out quite well and was continued for the balance of the life of the line.

Although the State of Michigan was proceeding with road construction, the railroads were still the preferred means of transportation. Miss Carrie Mears of Pentwater recalls that in making a business trip with her aunt from Pentwater to Walkerville it was the more convenient to travel first to Buttersville, and then to take the narrow-gauge passenger train from there. She describes the narrow-gauge coaches as "very comfortable and cosy."

For a number of years there had been public sentiment in favor of extending the Mason & Oceana southward to Hesperia, or even farther. It was expected that the narrow-gauge would connect with the Slocum branch of the Muskegon, Grand Rapids & Indiana R. R. near Fremont, Michigan.

During 1900, the work of extending the M & O was begun. Notes to finance the extension were sold to farmers along the route, and donations of right-of-way were accepted from them. The railroad appealed for help from the note-signers in doing the grading near Goodrich, being anxious to start construction of the bridge over the White River before the winter set in. Twenty teams and forty men were requested. Farmers pitched in with shovels as well, to help by hand, so anxious were they to see the benefits of modern transportation conferred upon their community.

The five mile extension to Goodrich is variously reported as having been opened July 1, 1901, or June 10, 1902. The articles of the line were amended, effective August 12, 1901, changing the southern terminus to Newaygo, 70 miles from Buttersville. They were amended again, effective April 7, 1902, this time specifying the charter route as from Buttersville to Grand Rapids. On June 1, 1903, another five miles of line was opened from Goodrich to Maple Range. Although railroad fever was running high, no passenger service was provided at first upon this extension, it being operated merely as a logging spur out of Walkerville. Later, service was provided for one summer only, Hesperia residents taking teams and wagons out to where the road crossed the railroad.

It is difficult at this late date to assay just what the intention of the operators of the railroad might have been with regard to this southern extension. Involving as it did the large bridge over the White River, the largest on the line, it would have seemed only logical to justify this heavy construction by going on into Hesperia, a distance of only a

little over four miles more. It would have been possible to tap more traffic, and it most certainly would have upheld public confidence. But it seems that logging was still the primary purpose of the line, for during 1906 the section from Maple Range to Goodrich was abandoned, the timber being gone. Public feeling ran high. Charles Rumsey relates, "The people here would have liked to have skinned those Birds alive."

Another extension from Lake Station to Colfax, three miles, was opened in 1900. This never had passenger service.

The branch and extension now gave the Mason & Oceana a total mileage of 45 miles. There were seven stations and 16 highway crossings. The telephone line reverted to the Pere Marquette Telephone Company. Rolling stock, except log cars (!), was being equipped with solid automatic couplers from the Michigan Malleable Iron Company. In 1901, enginemen, the highest paid employees, were receiving $2.50 per day.

And now began some rather involved schemes. On April 3, 1902, the Grand Rapids City Council granted a franchise to the Grand Rapids, Ludington & Northwestern Railroad, for the construction of a belt line in and around the city. Note how closely this date coincides with the change in the charter of the M & O, naming Grand Rapids as the southern terminal. Also, there is no evidence to indicate that the G. R. L. & N. W. R. R. had as yet bothered to obtain a charter from the State! The group which obtained the franchise were known as the "Butters Syndicate," with Marshall F. Butters as president. A Mr. Updyke from a Chicago investment house was also active in the promotion of this project.

Evidently the idea of constructing a railroad from Grand Rapids to Ludington, using the Mason & Oceana, lay more or less dormant for awhile. But in January of 1907, a twelve man surveying crew was busily at work near Walkerville, under contract to Marshall F. Butters from the National Construction Company of Chicago. They announced that the most difficult part of their work was finished.

The next we hear of the plan is February 1, 1908, when the Grand Rapids & North Western Railroad Company was granted a charter from the State. Marshall F. Butters was president of the company, with officers and directors from Grand Rapids, Chicago, Milwaukee, and Philadelphia. The company was authorized to issue $5,000,000 worth of stock. The terminals were to be Ludington and Grand Rapids, the entrance to Grand Rapids being at the Bridge Street Terminal of the Grand Trunk Railway. It was planned to operate car ferries out of Ludington across Lake Michigan to Milwaukee, and possibly Sheboygan.

And now we shall leave the Mason & Oceana in its present state of development, along with its allied enterprises, to inspect more closely its equipment and operation.

During the time previous to its incorporation, the M & O is said to have operated as many as nine engines at one time. Information on these early operations is extremely scarce. The service was severe, and engines were continually being scrapped and replaced. There was a considerable fire at Buttersville in 1891, which may have destroyed some of the motive power. After 1906, numbers 1, 2, 5, 6 and the Buttersville "Dinky" were the only engines in regular service. The following roster is correct for the later years of operation.

Locomotives of the Mason & Oceana Railroad

Number	Type	Builder	Remarks
1st 1	2-6-0	Grant	
2nd 1	2-6-0	Grant	Formerly Northern Pacific. Bought at Hegewisch, in 1904. Named "Robert H. Butters." Sent to L'Anse 1910.
1st 2	2-6-0	Grant 1872	Named "Marshall H. Butters." 14"x22" cylinders.
2nd 2	Shay	Lima #108 1884	Scrapped 1902-1903. 10"x10" 26"
3rd 2	2-4-0	Shenectady	Formerly standard gauge. Leased from F&PM. Used for swamp service. Sent to Mexico 1910.
1st 3	4-6-0?	Lima	
2nd 3	Shay	Lima #154 1886	10"x10" cylinders. 28" drivers. Sold to Johnson & Pollack Lumber Co., Mt. Hebron, Calif.
4	2-6-0	Baldwin	
5	2-8-0	Grant	Had steam flangers. Did most of main line work. Went to Peters' property at Manistee in 1910.
6	2-6-0	Grant	Passenger service. Sent to L'Anse 1910.
7	2-8-0	Grant 1882	Scrapped before 1903. 16"x20" cylinders.
1st "Dinky"	0-4-2T	H. K. Porter	Buttersville switcher. Scrapped during '90s.
2nd "Dinky"	Geared	Lima?	Upright boiler. Came from Dolan Lumber Co. Sent to Mud Lake 1910.

Coaling stations were located at Buttersville, Walkerville, and at "Long Siding" just below Fern. Coaling was done by hand from carloads of coal spotted at these points. There were water tanks at Buttersville, the Pentwater River, Fern, Isaac Hill just south of Peachville, and south of Walkerville. The tank at Isaac Hill was fed by gravity.

The turntable at Buttersville was removed during the 90s and replaced by a wye to the east of town. There was a wye north of Walkerville about two or three miles. There were various other wyes maintained at other points in the logging trackage as the need arose. Peachville, since it became the camp center during the middle years of operation, is believed to have had a wye until about 1905.

The initial passenger equipment consisted of a coach, origin unknown. Mention has been made of a car to handle mail, and it appears that this was replaced with a combine after it was certain that the contract would be held. Prior to 1900 this passenger equipment was replaced with a coach and combine obtained second-hand from the Bradford, Bordell & Kinzua Railroad in Pennsylvania. There was considerable variation in the color of the passenger rolling stock. Probably it changed according to the tastes of the shopmen, or to what colors of paint were cheaply available. The coaches are reported to have been, at various times, maroon, dark green, grey, brown, box-car red, and at the end, a mustard or yellow hue. Lettering with the maroon and dark

green was gold-leaf, with the rest of the schemes, white paint. Upholstery seems to have been renewed several times, and was either green or red plush.

Freight rolling stock was principally log and flat cars. Company shops built almost all of this equipment, supplying the timber and buying trucks and hardware on the outside. Both the Grand Rapids and Russell types of logging cars were used, but the Russell cars were preferred by the trainmen because of their lower center of gravity and better riding qualities. Many of the flats were given sides and used as gondolas for hauling coal, staves for the barrel factory, and other materials.

During the early years of operation, freight trains were run as often as there were logs to be brought from the forest, which meant almost constantly. Trains would consist of from 10 to 40 cars, depending on the engine, and whether empties or loads were being handled. The geared engines worked the spurs in the woods, with the rod locos handling the line hauls.

There was a steep grade leaving Buttersville, so a helper engine was often needed. The yard "Dinky" was usually pressed into this service. Clifford Orr tells how grades out on the line gave trouble, too, frequently stalling an engine and train. When this happened, the crew would stop, take off the cylinder heads, remove the piston rings, pound them on the track to flange them out and make them fit more tightly, replace them, and continue!

In later years, operations settled into more of a routine, with an "understood" timetable. No. 1 would leave Walkerville in the morning with the passenger train and perhaps a box car or two. No. 5 would start from Buttersville with empty log cars, the two meeting at Long Siding (Fern) and exchanging trains. No. 1 would then go back on the line to continue fetching logs to Fern and returning empties, while No. 5 would take the passenger train into Buttersville, and leave the coaches there until evening. No. 5 would then shuttle between Buttersville and Fern until all the logs for the day were in. The two crews would be finished with their work by early afternoon, and then nothing would move until the evening passenger train was run southward. In the Fall, when the movement of produce from Walkerville began, this schedule was reversed so that the passenger train ran from Walkerville to Buttersville in the evening, with the loads of produce bound for Milwaukee coupled into it.

Green tickets with black lettering were used. The fare from Buttersville to Wiley was 9c. No timetable was ever published as such, but cards were printed for display in public places, and timetables were published in the Ludington papers. The following are representative:

Mason & Oceana Timetable

TAKING EFFECT APRIL 6, 1904

PM				AM	Miles
5:00	Lv.	Buttersville	Ar.	8:15	0
5:30		Riverton		7:45	7
5:40		Wiley		7:30	11
5:55		Fern		7:15	15
6:40		Peachville		6:30	23
7:10	Ar.	Walkerville	Lv.	6:00	27

TAKING EFFECT OCTOBER 1, 1904

AM				PM
8:00	Lv.	Buttersville	Ar.	12:25
8:30		Riverton		11:55
8:40		Wiley		11:45
8:55		Fern		11:30
9:35		Peachville		10:50
9:55	Ar.	Walkerville	Lv.	10:30

TAKING EFFECT OCTOBER 8, 1906

PM				AM
7:45	Lv.	Buttersville	Ar.	4:15
8:15		Riverton		3:45
8:30		Wiley		3:30
8:45		Fern		3:15
9:40		Peachville		2:20
10:00	Ar.	Walkerville	Lv.	2:00

NOTICE

Trains connect with the ferry, Ralph M. Cooper, for Ludington. The company reserves the right to vary the time of its trains at pleasure. All trains run on Central Time.

Trains run daily except Sunday.

C. E. BUTTERS — Gen'l. Supt.
M. F. BUTTERS — Gen'l. Mgr.

TAKING EFFECT APRIL 1, 1907

PM				AM
5:00	Lv.	Buttersville	Ar.	8:00
5:30		Riverton		7:35
5:45		Wiley		7:20
6:00		Fern		7:05
6:40		Peachville		6:20
7:00	Ar.	Walkerville	Lv.	6:00

TAKING EFFECT DEC. 23, 1907

AM				PM
8:00	Lv.	Buttersville	Ar.	3:30
8:30		Riverton		3:05
8:45		Wiley		2:50
9:00		Fern		2:35
9:40		Peachville		1:50
10:00	Ar.	Walkerville	Lv.	1:30

Occasionally there would be a Sunday school picnic or excursion on the line. In the very early days it was customary to run a special train on Saturday nights to bring the lumberjacks to town to engage in drinking, shooting and other wholesome forms of recreation. Newspapers of the period are filled with accounts of sudden death.

There was a baseball team at Buttersville named after the railroad, though not officially connected with it. On Sunday afternoons they would draw quite a crowd to Buttersville. Sometimes the M & O would run a special to bring in the baseball fans. On at least one occasion the team chartered a train to go to Walkerville in order to play the Indian team there. The M & O team had dark green uniforms with bright red lettering. What a sight they must have made, lined up along the little yellow coaches! George Warden was captain.

The Butters Company provided ferry service between Buttersville and Ludington, as mentioned before. The fare was 5c. Normal service was about every 45 minutes, but on Sundays when the ball games were in progress, the ferry was constantly plying back and forth, with perhaps a small scow in tow to handle the overflow.

This marine auxiliary was quite an important part of company operations. A number of different boats were used between Buttersville and Ludington, among them the "Maude Lilly," the "Helen Scott," the "Helen Taylor," the "Sprite," and the "Ralph M. Cooper." Then there were the carfloat scow, and the small one mentioned above. Pride of the fleet was the large lake freighter, the "Marshall F. Butters." It was a familiar sight in all the larger ports on the Great Lakes for many years.

Getting back to the railroad, free rail service was provided for shoppers to Walkerville, on several occasions when the company store at Buttersville burned.

In spite of the grandiose plans for building on to Grand Rapids, operation of the line continued to be dangerous. Bert Gerard remembers that there were "galores of wrecks." Bert Ellis tells about the time going down Wiley Hill when a log broke from the reaches or "bunks" of the car as it passed over a dip in the track. The car derailed, and those following it jack-knifed in all directions. Bert jumped off the train, ran into a barbed wire fence, and came uncomfortably close to being under a pile of 15 cars. He tells about another time at the foot of Isaac Hill when a wreck buried a brakeman under 35 cars. He was unhurt, except for a few scratches. Bert's uncle was killed on the line, though, when one of the long timber "roosters" used for separating log cars with long loads jumped sidewise during a coupling and crushed him. Almost every man who worked on the railroad had a maimed hand or limb to show for his service.

About midnight on August 25, 1909, a blaze was discovered in the "hog house" at Buttersville, a building separate from the main plant, where wood was ground up for fuel. It may have been caused by an overheated bearing in the system of pulleys and belts under the building, or it might have been the result of spontaneous combustion in the sawdust which was everywhere about the premise. Everything was bone dry as the result of several weeks without rain. A high wind fanned

the blaze, which soon turned into a major holocaust, lighting the sky for miles, and rousing the people of Ludington from their beds to watch the spectacular display. The Ralph M. Cooper was narrowly saved from the flames, and presumably much of the railway rolling stock was burned. There was no fire department in Buttersville. It was necessary to wait for the ferry boat to get up steam to bring help from Ludington. By morning the sawmill, shingle mill, several thousand shingles, cooper shop, lumber yards, salt block, and docks were destroyed. Over $100,000 worth of damage was done; the company was able to collect $65,000 in insurance.

This was the beginning of the end for the Mason & Oceana Railroad, for it meant the loss of its main source of traffic. The Butters Company claimed that the railroad owed it a large sum of money in settlement of expenditures on its behalf. In the Fall of 1909, all of the Mason & Oceana capital stock held by the Butters Company was assigned to the Grand Rapids & North Western Railroad, with the G. R. & N. W. assuming the privilege of operating the line under reservation of lease, until required to abandon it for the use of the standard gauge right-of-way to Grand Rapids. Service continued until December 1, 1909, when the last trains were run over the stretch of snaky narrow gauge. On the Monday previous, Robert Butters, another of Horace's sons, gave a farewell party on the line for a group of Ludington merchants, professional men, and citizens. Officially, the Mason & Oceana was through.

Rails from Walkerville to Wiley were removed, but the remaining twelve miles to Buttersville were left in place to facilitate standard gauge construction the next Spring.

The next few years saw sporadic bursts of construction activity, a steam shovel and crew being employed at grading in the vicinity of Walkerville. All of the grading for the new line was completed between Buttersville and Hesperia, and much was done south of there, especially near Grand Rapids. Forty miles of fencing were in place, but no standard gauge ties or rails were ever laid. Finally, all construction work was suspended in June of 1914.

Some of the equipment was sent to Boardman, North Carolina. The passenger cars and most of the rail went to Mexico. Fifteen or eighteen of the logging cars went to Mud Lake, Michigan. No. 5 and some cars were loaded on the "Marshall F. Butters" and taken to L'Anse, Michigan. The disposition of the other locomotives is given in the roster, where known.

After this last sad job, the Marshall F. Butters was sold to the Stearns Company. It broke in two in a storm on Lake Erie, and sank on October 20, 1916.

With both the mill and the railroad gone, few people had any reason to continue living in Buttersville. Most of the remaining houses were moved to Ludington. In a few winters the pounding, howling fury of Lake Michigan removed the remaining traces of the town, leaving the sandy peninsula as it was originally. Buttersville became a ghost town.

The Mason & Oceana Railroad was no more. In years past it had contributed materially to the prosperity of the region it had served so faithfully. The snaky little narrow-gauge had transported nearly half a

billion feet of virgin timber during its lifetime. It had been an active agency in changing the wild Indian country into a settled, stable branch of civilization.

To see the smoke pour out of the diamond stack of one of those little mills, and to hear her struggling exhaust bark sharp was a pleasure. To hear one of the peanut whistles shriek out in the clear Michigan air was a real thrill.

Those were the days on the Mason & Oceana. It brings a lump to one's throat to think of those shiny, pint-sized cabbage-cutters swaying through the tall timber with their loads of wood trailing in a jerking line behind, or to imagine how that little bob-tailed string of varnish must have looked scooting across the trestle at Squaw Bay. In your mind's ear perhaps you can hear those peanut whistles shrieking through the hills, with the exhaust wheezing as the leaky cylinders poured out clouds of steam in the cold winter air.

Now all that remains of the M & O is a few ties breaking the clean surface of the new fallen snow; or in Indian summer, if you peer hard through the evening haze, you may be able to see a billowing cloud of black smoke in the distance.

The "Miserable & Ornery" passed to the scrap pile years ago, but she'll always stay in the hearts of those who knew her.

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FOREWORD

The actual diary of Horatio Allen, as transcribed herewith, completely fills one "composition" book, about eighty-eight closely written pages, and covers Allen's activities in England from the day he landed at Liverpool, February 15th, 1828, until at least April 17th, 1828, which is the latest dated entry.

Allen makes the statement (Diary page 36) that the L. & M. tunnel is expected to be completed in June, and he says, "I hope to walk through it," indicating that he anticipated being in England until that time. Under date of July 19th, 1828, Allen wrote a letter to the Managers of the D. & H. Canal Co., in which he stated that he had placed orders for three locomotives with Foster, Rastrick & Co., and one with R. Stephenson, a further indication of the length of his stay abroad.

No mention is made in this diary of the locomotives ordered or even of any contact with the builders regarding them, but, judging from the meticulous reporting of details and information acquired, there is little doubt that Allen kept up his diary for the balance of his time in Great Britain, although any other volume or volumes covering this period are not known to exist.

The hand-writing and, in some cases, the phraseology have presented a few difficulties in transcribing, and it has been necessary to make interpolations and to add some punctuation for the sake of clarity. These have been done with the view of so doing without altering the sense of the entries.

In spite of the fact that Allen's record of the latter part of his trip, and of his all-important transactions regarding the "locomotive engines" are missing, this one available volume gives valuable insight to the problems of the world's first railways, when there was no previous experience upon which to base judgment, and nearly everything had to be done by the "trial and error" method.

The transcription from the original diary was made by the late W. J. Coughtry, and by Messrs. Jesse Burt and F. Stewart Graham.

The numbers in the left hand margin indicate the page numbers of the original diary.

THE EDITORS

Diary of Horatio Allen

1828 (England)

1828, February 15, Friday

(1) On this day I landed on the dock at Liverpool. We had turned into the river Mersey about nine o'clock, which stream joins the sea about six miles from the town. As we turned the point the town came in sight, situated on the right bank of the stream, upon ground rising from the river. In the stream itself but few ships, excepting the fleet that was in company with ourselves approaching their destined haven, were to be seen. But as appeared to our eyes amidst the walls

of the town a forest of masts arose. The suburbs of the town were lined with windmills and many tall chimneys showed the situation of factories. The town itself looked very much like an American city except that its walls were uniform in colour and that colour a sooty black. A canopy of coal smoke hung over the town. The tide would not permit our entering the docks and the vessel that had brought us so rapidly and pleasantly to this land of strangers was anchored near the walls of the dock, and in company with the captain and my fellow passengers we took a boat and landing at about 10 o'clock. As the vessel approached the dock we observed it lined with all classes of citizens apparently anxiously awaiting the arrival of the ships. When we landed and for the first time (for my part at least) stood upon English ground I had so much else to think that I forgot to be rapt with the idea of first time visiting the land of Bacon and Newton, of Milton and Shakespeare, the land where repose the ashes of our forefathers, from whose deep founts
of civil and religious liberty we have in America drawn so much.
(2) We passed over the bridge which is thrown over the dyke
connecting Princes Dock and the Mersey. I did not feel in the least like a stranger, the scene was very much like New York. Our route lay along Princes Dock which contains the American vessels, and there was a display of American vessels that was gratifying to the American eye. But more of these docks hereafter. We proceeded along the dock until we came to Chapel Street and going up it a short distance the Captain, who was our guide, stopped at Mr. Brown's Counting Room. As I had not my letters with me I waited for him at the door, not liking to be introduced without my credentials. While I waited a gentleman came down and I at once knew him to be Mr. William Brown. He addressed me and finding that I was Mr. Allen invited me upstairs. Reception of me was most gratifying and friendly. "His house" he said "I must make my home." The invitation was given in a way that showed that it was to be accepted. With proper acknowledgements I accepted it. As he was to dine out that day our arrangements were made for me to go home with him at 10 o'clock in the evening and, in the meantime, I was to get my luggage ashore and dine with the Captain at his boarding house.

Leaving his Counting Room I went to a boarding house kept by Mrs. Richards and there procured a fine dish of coffee and a relish that relished admirably. From the boarding house (which was at the corner of Slater and Duke Street) I returned to the ship with the intention
of getting my baggage on shore, but after waiting some time I
(3) found that it would be useless to attempt it that day and, not
feeling very well, took a warm bath and returned to Mrs. Richards. The bath I believe did me no good as I continued indisposed. I dined with the Captain and there was a merry set at the table, but I felt so unwell that I could not enter into the gaiety. Heavy indeed did the hours wear on from 6 until 10, when Mr. Brown called for me on his way home and took me into his carriage. He introduced me to his wife and after sitting a few moments I most gladly retired to my bed not before, however, having taken Mr. Brown's advice and preparation,

something to relieve the intolerable headache that almost drove me crazy. Two-thirds of the night was spent in a good deal of misery but during the latter part I grew better and obtained some sleep and awoke the next morning much refreshed.

Feb. 16, 1828.

When I descended into the breakfast room, Mr. Brown showed me into the breakfast parlour and selected from among his books and papers such as he thought would be interesting. At breakfast I met his lady and daughter (a young lady of about 15) and son about 4 or 5. After breakfast he proposed a walk among the docks which I quickly assented to, but mentioned that I must first attend to my baggage. We made arrangements then to meet during the morning. We went down to his Counting House in the gig. From his Counting Room to the ship, from the ship to the custom house and, after running to about a dozen clerks,
I succeeded in obtaining leave to send the porter up with my
(4) baggage. At ½ past one I met Mr. Brown pursuant to arrange-
ments and proceeded to examine the docks.

The docks in Liverpool are large basins of water connected with the Mersey by locks capable of passing ships of the largest size. There are at present 45 acres of area contained in the docks now made and in operation. Their arrangement and situation may be seen by reference to the map of the town. The masonry of them is of the most perfect kind and the whole construction of the most durable nature. Princes Dock is appropriated to American vessels and is the pride of the town. From the old docks we went to the works now constructing under Mr. Hartley, who is the engineer. He is a man of the highest standing for talents and practical skill. I was highly pleased with what I saw and hoped for a more particular examination. From the docks I returned with Mr. Brown a little before 5, at which hour Mr. Brown expected Mr. Hartley and several gentlemen whom he had invited. Before dinner I was introduced to Mr. West, Mr. W. A. Brown, to several other gentlemen and to Mr. Hartley, whom, of course, I was most anxious to see. At dinner little could be said on the topics most interesting to me and I could only observe the countenance and appearance of the Engineer of the Docks. His height is about 6 feet and frame strong and heavily moulded, with a full face and a cast of countenance between an Englishman & a Scotchman. A clear blue eye and a good forehead exhibited I thought considerable appearance of thought. His accent is between
English & Scotch with the usual preface of an "H" to each
(5) vowel commencing a word. From his conversation and manner
I should suppose him possessed of a benevolent disposition and great good humour. Our company departed at about 11 and I once again committed myself to the pleasures of sleep. Thus have been completed my first two days in Liverpool and on English ground. Of the town itself I can say but little as regards beauty. It is certainly inferior to New York, Philadelphia or Baltimore. The houses on the outside are built generally without any attempt at ornament, of a large sized brick which when new has a very unsightly appearance, but when it has re-

ceived its annual coating of coal smoke and dust for 4 or 5 years, and perhaps in most cases 40 to 50 years, it has a most gloomy, unpleasant aspect. In other respects very much like New York. There are a greater number of squares and the streets are much more crooked than in New York.

Sunday, Feb. 17, 1828.

I went to church today with Mr. Brown and family to the Blind Asylum, an institution of charity for relief of the blind. They have a fine organ and the choristers are blind persons connected with the institution. They sang with remarkable accuracy a variety of hymns and chants. In this church the responses are all chanted by the choir, and the congregation sit and listen to the alternate voices of the clergyman and choir. One of the great beauties of the Episcopal Church is thereby in my opinion. In other respects the service was much the same as ours. The sermon was but commonplace. In the congregation there was less fashion and beauty than we usually meet with in America.
(6) The ladies did not dress with as much taste as in New York, and a much greater variety of costumes prevailed than in New York. About half of the seats in the church are left for strangers, who pay a shilling at the door, which goes to charity. It is much resorted to by strangers on account of its music, though on the day that I attended it did not strike me as superior. The remainder of the day was spent in Mr. Brown's family.

Monday, Feb. (18).

Agreeable to an appointment made with Mr. Hartley, Mr. Brown and myself at 9 went down to the docks. We found him at the north end of the north docks. In constructing these works much expense is gone into to prepare for the execution of them. Steam engines are put up to areas of the water; railways are laid down, crossing the work in many directions. Upon these ways the material is taken out by means of horse power. The rails formerly made use of were of the tram kind, 3 feet long, clumsily made; at present they are using the trams where they have, but all new rails are of the edge species. They are laid down in the most temporary manner. The surface is laid by the eye and joice; short pieces of timber four or five inches square are placed across the direction of the road; on these timbers the chair is pinned and then the rail put on the chair. At the wharf where the stones are discharged from the boats, large cranes are erected and a steam engine employed to raise the stone. At one place they were building an engine house to work a set of pumps when the water required it, and next (used)
(7) it at (the) incline to draw up the waggons from the lowest point in the dock. The inclination was to be 2 : 1. Large cranes were to be seen in every direction for loading and placing the stone. A building had been erected for the purpose of making their mortar, the stones were driven by a steam engine. Another building is going up on another part of the work to perform similar work. From the manner in which the buildings are put up and the arrangement of machinery one would

not be led to suppose they were merely put up for the construction of the work. In moving large stone from one place to another, a species of waggon is used called a "chariot," a draught of which I intend to obtain. In raising the stone Lewises are used.

(Sketches of a "Lewis")

To use them a hole is drilled into the centre of the stone, with parallel sides and the ends flaring inwards, so that the bottom of the mortice is parallel with the top, but the length of the mortices is greater than at the top, as much as the Lewis is wider at the bottom than at the top. By this means the largest stones are moved with the greatest facility as regards obtaining a hold on to the stone. Six steam
(8) engines are employed, one at the shops and five on the works. A
great part of the excavation is of sandstone rock varying much in the degrees of hardness, from hard enough to use in the masonry down to a stone that crumbles in handling. The remainder of the excavation is sand. When the stone is sufficiently good to go into the masonry they quarry it without powder, but the softer stone is much of it blasted out. The masonry is of the most superior character, probably not equalled in the world. The great excellence consists in having very large stones which are wrought to a surprising accuracy. Each bed is brought to a perfectly smooth level and uniform surface so that when two stones are laid together the space between them is not more than one-eighth of an inch and frequently not so much, so that they are almost independent of the cement and the quantity used is trifling. In making the plan of the work the greatest detail is gone into. An elevation of the whole wall from one end of the dock to the other, showing the thickness and length of each stone, and each stone is marked on the plan. A plan of the wall through each course is also given which exhibits the breadth and length of the stone, so that on the plan the length, breadth and depth of each stone is accurately determined; these dimensions and the mark corresponding to each stone is given to the workmen, whose orders are to work it into as true a face as possible. The stone is obtained partly from their own excavations, partly from the excavations on the Liverpool & Manchester Rail Road, and part from a place ten miles up the River. It is nearly altogether the red sandstone, but a red sandstone of less firm texture and I should think of less durability than
(9) ours. The facility with which it is worked renders the masonry
much less expensive than it would be with a harder kind of material.

The steps and the parts of the works most exposed to the friction are made of a granite brought from Scotland, a beautiful stone of great durability. The tide rises and falls here such great heights that the foundation of part of the river wall is exposed at low tide. In most places they are able to get down to the solid rock. When this is practicable a diving bell worked by air pumps is employed. The rock is cleared of its sand and a bed cut into the rock of eight inches or a foot, and the lower bed dressed as true as possible and then the stone, by means of a tackle, let down into its place, thus obtaining the best foundation

possible. In cases where the rock is too deep, they have recourse to piling. The sheet piling is of cast iron of the kind described by Strickland. The lower courses of masonry are not laid with close joints in the back part, but frequently left 8 to 16 in. apart and filled in with Brickwork well grouted. The stones are brought on to the work by means of chariots. A staging of timber sticks about 12 to 16 in. square is carried horizontal from the finished wall exactly over the masonry below. The stone is suspended below the axles of one of the chariots and the chariot then rolled to that point in the staging which is precisely over the spot destined for the stone. When brought there it is let down by means of a fall and tackle to the very spot that is prepared for it. I have as yet seen no iron clamps used in the work.

(10) The stones are frequently 6 to 8 feet by 3 to 4 by 3 to 5. Such materials and workmanship must make very permanent work, as permanent as solid rock. From the works I went to the office of the Dock Agents where all business is transacted, plans made out, &c. A great proportion of the work is done by days work. A large yard is attached to the office, which contains a great variety of work shops, almost every trade having its representation there. A steam engine of 4 horse-power is put up in it, which drives the machinery for turning the iron, &c. Blacksmiths, carpenters, sawyers, wheelwrights, millwrights, &c are all here employed by the day. A storehouse is attached to the premises where every material is kept. The system of management is very perfect. A weekly bill is made of all work done in each line. The weekly book specifies what the thing made was, when used & what the expense of material and what the expense of the workmanship. For instance, a wrench is required for one of the gates. Application is made to the gangman of the blacksmith, who goes to the clerk in the office; from this clerk he obtains an order for the quantity of iron which he deems necessary. By virtue of this order the storekeeper delivers him the iron, noting the weight. The workmen then make the article, and bring it & the surplus material, if any, to the storekeeper, and tell him how long he has been employed in the work. In this manner the cost of material is determined and, from the time employed, the cost of work. From this arrangement the weekly account rather presents an appearance of an account

(11) of work done for the company than by the company's own agents. There are no charges for days labour, but everything is paid for by the charge for the expense of construction.

I took a cursory glance at the drawings in the office but deferred any notes until another time when I should be better prepared. At 2 o'clock I dined with Mr. Hartley in his office. A keen appetite and a tender beef steak laced with a couple of glasses of ale enabled me to make a most capital repast.

After dinner, we proceeded again to the works. I accompanied Mr. Hartley through all his movements though the scene was similar to what I had seen before. At ½ past 6 in the evening, when it was quite dark, we went to see the work done by the diving bell; the tide did not reach its minimum until past 7, and then we were enabled to examine the masonry executed by the men in the diving bell, when the water

was 20 to 25 feet over their heads. There was nothing peculiar except the situation of the workmen in doing the work. It appeared as well done, and with as much care and accuracy as have been done in more convenient situations. The masons were taking advantage of the couple of hours that the tide permitted their working. It was a most interesting sight that we were present at. About 100 men were engaged on the foundation of the works, all working by torch light. Above them the staging supported the chariot and labourers employed in bringing the stone. As but a short space of time was allowed them by the recess of the waters, every one did his utmost and they were grouped together around each stone as numerous as they could well work together. We went through the line of the river wall, partly on the masonry and partly on the sand which afforded a pretty good foundation, only
(12) sinking an inch or two. The hour & a half that I spent on the works in this way was very interesting indeed. When we left it and looked back where the work was going on it was like looking on a city, the numerous lights presenting very much the appearance of streets lighted up. About ½ past 8 I returned to Mr. Brown's hospitable mansion and found that the ladies had gone to a concert given by an Italian lady, Madam Pussi. I did not regret that I had been differently employed. I spent the interval before they came back in writing, and after a good supper I retired to bed delighted with the manner in which I had spent the day and rejoiced in my good fortune of having the advantage of most kind friends and friends so well able and willing to assist me in the objects of my visit.

Tuesday, Feb. 19

This morning was principally employed in making some purchases of papers, instruments, &c. that I stood in need of. When I returned to the house, I was going to stay home so little do I feel myself a stranger, I employed myself in writing until dinner. After dinner I went with Mr. Brown down to the docks to take another night view of the labourers and masons at work. The tide, however, did not fall sufficiently low, though the scene was similar, to afford a good view of the manner of putting in the foundation. I did not see Mr. Hartley today, but tomorrow I am to have another interview with him and a more particular examination of his plan. I find him perfectly willing to answer all my inquiries and every communication of his valuable, practical knowledge.

(13)

Wednesday, Feb. 20

This day has been spent very profitably and pleasantly in the office of Mr. Hartley in the midst of his plans. He himself was much engaged and I was left to take such notes of his plans as I deemed advisable. I took plans of a hand pile engine, the drawing of which explains itself, of the roof of the sheds on the docks at Liverpool, of the arrangement, length &c. of buckets for a chain pump. I also took dimensions of the thickness of the timbers of a lock gate, but did not get the breadth.

Heel Post	27.6	br.	1.9 in.	Toe Post	27.6	Br.	1.6
Top rail	1.3	T piece	Be 2.00	9 &)	1.03)		
				)	)	T piece	.09
2 Rail	9	T piece	Be 2.00	10 Rails)	1.03)		
3 Rail	11	T piece	Be 1.09	11 &	1.00)	Head above	
					)		
4 Rail	1.02	T piece	Be 1.06	12 Rails	1.06)	Upper rail	1.00
					)		
5 &	.10)	T piece	Be 1.03	13 &	1.06)	Bed below	
	)				)		
6 Rails	.10)			14 Rails	1.06)	Lower rail	.06
7 &	1.00)	T piece	Be 1.00		8.00		2.03
	)						
3 Rails	1.00)						
	7.09		9.06				

$7.09+9.06+8.00+2.03=27$ ft. 6 in.

Angle of the locks gates by measurement on the plan is 28 degrees, which Mr. Hartley stated he considered the best angle. The hypothic view of the plan was 26.9½ to 9-9 inches perpendicular. The upper timbers are dressed to a curvature of 10 in versed sine to their length, 26.9½. They are so dressed in order to give strength without weight to the gate. In speaking of embankments and their pressure against a wall he stated that he considers it very material to commence the filling in next to the wall. He thought by this arrangement the medium assumed a stratified situation that tended to settle it at the centre of the back and that the pressure against a wall would be much less than
(14) it would be when filling from the centre towards the wall. His idea may be illustrated by the sketch of the filling in between the two walls A & B, commencing at A, & filling towards B.

(Sketch on page 14)

The pressure on B. will be evidently greater than on A. Figure 2 will represent the direction of the strata when the filling between C & D is done properly.

From a section of his dock walls I took the following dimensions for the thickness, &c., of the River and inside wall.

Inside Wall. 5 feet on top.
35 feet high. 12 feet on the bottom.
Front slope. 1½ to the foot.
Back breaks off plumb by 2 square offsets. Stones laid perpendicular to the face.

River wall. 5 feet thick on top.
40 feet high. 10 feet thick on bottom.
Front slope, 2" to the foot. Back breaks off with 3 square offsets, curved from one offset to the other, parallel to the face.
120 feet from edge of one wall to the other.

Water let into the lock by two culverts 2 feet square.

In all the plans great accuracy was centered into a view given of the structure in every direction. With the plan there could be no mistake. Nothing was left to guessing. All, too, were done on a large scale and different colours employed to distinguish between different parts of the work. From the office I returned to Mr. Brown's, from where at 5 I

went to a dinner party at Mr. Wm. A. Brown. At Mr. Brown's I met several gentlemen, who by their conversation, I should judge to be merchants. The dinner was served up in very handsome style and the ceremonies of the table very much the same as they are in America.
(15) The conversation was principally on political subjects and the changes lately made in the ministry. Mr. Harkisson's conduct was much spoken of and alluded to as being the future prime minister of the country. From the dinner table the carriages called for us to go to a party at a Mr. M. A. It was about 8 when we went. We found a party of about 50 ladies and gentlemen assembled. Our names were announced by the servant at the door. They were concluding tea as we entered, 6 or 7 card tables were spread and the persons engaged at them appeared quite interested in the game. We had no opportunity for a seat and found ourselves in the midst of a crowd who appeared to have little else to do than to mill about and stare each other in the face. The gentlemen were dressed and appeared very much like gentlemen in America, except that the eyeglass was rather more used by the young men. The married ladies were dressed more gay than the others and did not appear so matronly. The young ladies much the same as in America, but rather inferior in point of beauty. At about 10 the younger portion of the assemblage descended into the lower room and danced for a couple of hours. I was introduced to the belle of the party, a Miss Henderson, quite a pretty girl, and had the honor of waiting on her downstairs, and dancing the first quadrille with her, or rather the first pair of quadrilles, for they have here the custom of dancing two sets in succession. We danced 4 or 5 quadrilles & at ½ past 11
(16) had a table spread and light refreshments placed on it. At the table only young people sat down and helped their neighbours. After the collation was partaken of, we danced a number of quadrilles and then separated. The evening passed very pleasantly indeed. I found the young ladies quite conversational and pleasing. The figures that are danced are similar to ours but with not the variety. In fact we had no variety as we danced the same figures every time. The ladies danced very well but were not very remarkable for their grace or elegance of motion. In performing what is called right and left they do not take hold of hands, but dance past each other without touching each other.

Thursday, Feb'y 21, 1828.

I employed this morning in making out the plans from rough copies taken at Mr. Hartley's office. After breakfast I accompanied Mr. Brown to the Market, which is a most extensive building, said to be the largest building under one roof in Europe, being 183 yards long, 45 yards broad. A minute description will be found in the "Stranger in Liverpool." It was a fine place to resort to, to obtain an appetite. After returning from the market I occupied myself in writing until dinner time, when I was to have the pleasure of dining in company with Mr. Stephenson, the Engineer of the Liverpool and Manchester Rail Road. Mr. Hartley was also expected to have come and I was to have the pleasure of dining in company with two of the first Engineers in England. Business, how-

ever, took Mr. Hartley to Chester and we were disappointed in his
(17) not coming. Mr. Stephenson has nothing remarkable in his countenance. He has rather an ordinary appearance, and face destitute of marks of the talent that he really possesses. He is about 46 years of age, of quite obscure origin, and has risen to notice only within the last 5 or 6 years. The conversation before dinner turned upon the formation of coal. He has had a vast deal of experience in mining and has thereby examined the stratification of the coal formation with great advantages. He considers the coal to be altogether a vegetable production. He supposes that there have been great convulsions which have swept together into the same valley whole forests and by some mighty returning surge the mass of vegetable was completely covered with alluvium deposit and it has been hermetically sealed by the mud collected over it. When lying in this state the fermentation of the vegetable material commences, but the steam and gas not being able to escape they amalgamate with the carbon of the wood and coal is the result. From the coal mines, the conversation took a turn to the gas that collects at the bottom of the mines, the explosion of which is so injurious to the mines. The Safety lamp, which is usually attributed to Sir H. Davy was an invention it is said of Mr. G. Stephenson, the gentleman who was dining with us. By his account he had a lamp burning in the mine at the very time Sir Humphrey Davy was making his experiments.
(18) A committee was appointed by the Philosophical Society of Newcastle to inquire into the priority of the discovery, and determine to whom it was due. Their report was favourable to Mr. G. Stephenson and established his claim of being the first originator of the idea. Mr. Stephenson's explanation of the safety of the lamp is based upon the opinion that light will pass through a smaller orifice than flame will. And the explanation of the flame not passing is in the consideration that combustion cannot take place without a mixture of certain volumes of the gases requisite for combustion. The space necessary for this purpose is by Mr. Stephenson considered greater than the area of the orifice. From the gas lamp the conversation turned to the steam engine of Perkins. Mr. Stephenson gave us quite an interesting account of his visit to Perkins and of his examination of his engine. When he first called upon him, and was introduced to him by Mr. Stephenson, the Engineer of Newcastle, Perkins expressed great pleasure on seeing him, and said that he was one of the kind of men he desired to see, that the more his engine was criticized the more he would be pleased, being fully satisfied that a scientific scrutiny would end to his advantage.

Stephenson said that he examined the engine carefully. Perkins showed him a vessel into which the steam was injected after passing through the cylinder, and spoke of the introduction of a new dose of Atmospheric air into the steam, and thereby obtaining a power of a new description. Stephenson remarked that he was not satisfied with
(19) the working of the engine but, after closely examining the construction, &c, returned home and said little to any one on the subject. In a few days he called again and renewed his scrutiny into the working of the engine. He at length discovered that the pipe that Perkins said conducted steam into the vessel and then received a new

portion of atmospheric air did no such thing, but passed off into another room and there partially heated the water for his engine. Thus showing this part of the engine to be a complete hoax, and planned and intended to deceive the public. The second examination convinced Stephenson of the uselessness of the engine, and, upon leaving Perkins, expressed to some of his friends his idea of the power of the engine and said that though Perkins talked of 500 lbs. to the square inch, it was all nonsense; that he could stop the engine himself at any time. These and similar remarks reached the ears of some gentlemen concerned in the Mexican mining establishments. The gentlemen were on the point of making a contract for some of Perkins' engines to go to South America. They, through the medium of a friend sent, procured an interview with Stephenson and asked him if he had said that he could stop Perkins 8 horse engine himself; he said that he had made the remark and that
he believed that he could verify it. They then asked him if he
(20) would accompany them and make the experiment then. He agreed
to go and immediately the whole party went to Perkins' establishment. They found the engine at work and, stating the object of their coming, requested leave to make the experiment. Perkins agreed to it.

Mr. Stephenson then took hold of the rod that converted the reciprocating into the rotatory motion and, bracing himself properly before the engine had made many strokes, completely stopped the motion with his unassisted force. This of course produced great astonishment on the part of the spectators and Perkins did not seem well pleased with the event and the change that it had evidently produced upon the minds of the witnesses to this most conclusive proof of the inferiority. He made some excuses as to the state of the engine and said that it was far from being in good order. Some one then asked if he was willing to put it into good order and let Mr. Stephenson make the experiment if he chose again. He consented and a day was appointed when the contest of an 8 horse power engine against the strength of a single man was to be exhibited. At the time appointed "Mr. Stephenson said" a numerous party was assembled and the engine was working in fine style. He remarked that the engine was much more powerful than at the previous experiment, and took a new way to stop it. He picked up an old handle to a hammer and applying it to the surface of the flywheel
he put all his force upon it, and in a short time, a second time
(21) succeeded in stopping the engine entirely. He afterwards dis-
covered that a person was employed in pumping in oil at the very time he was making the experiment, which was taking an undue advantage on the part of Perkins. The result was such as astounded all who beheld it. Perkins, of course, did not relish it.

The Mining gentlemen gave up the contract and public opinion was they gave (it up) on very good grounds. In conversation with Perkins afterwards, Stephenson made Perkins this offer. Perkins should prepare an apparatus for working a pump and measure the day's work by the quantity of water raised in a day. A Wate & Bolton engine was also to be erected to be applied to the same machine and to do the same criterion. The quantity of fuel and water, &c, of each was to be measured. If Perkins' engine was proved to be the most economical, Step-

henson offered to bear the whole expense of the apparatus; but if the reverse was the case then Perkins must bear the cost of the whole arrangement. Perkins with apparent alacrity and pleasure entered into the agreement and requested 3 weeks to get ready. This, Mr. Stephenson said, suited him extremely well, as he was going into Ireland and would return at about that period, and desired a letter might be addressed to him at a certain place where he would be on his return, informing him of the time, &c. All this was agreed to. Mr. Stephenson went to Ireland and found on his return the promised letter; but with
(22) contents different from what he expected. Perkins was not yet ready, and advised his not waiting and informing him that he would apprise him of the preparations being completed.

Mr. Stephenson accordingly came to the north where his business lay and, from that day, has not heard a word from him. Mr. Stephenson afterwards saw Perkins engine at work on the Thames at pumping, but it was constantly getting out of order and finally removing. Mr. Stephenson related a circumstance with respect to the boilers made use of by Perkins, which certainly is no credit to him. A boiler was shown which was cracked. This crack Perkins represented to be the effect of the steam contained in it. Mr. Stephenson remarked that he thought it was the unequal cooling of the metal that had produced it, the bottom being thicker than the sides. He also observed and pointed out the blows of a hammer had apparently been applied to increase the width of the crack. He asked for the man who had taken the boiler down, and calling him in, requested permission to question him without his having any intercourse with Mr. Perkins. After his examination he acknowledged that he had used the hammer in the way and for the purpose that Mr. Stephenson had conjectured. Friction and the dimunition of it by oil was the next topic of conversation. His ideas on the relief obtained by the use of oil was that the particles of oil were spheres and acted as friction rollers; but if the pressure was very heavy the shape of the globules was altered by the pressure and became elongated and less perfect rollers. For this reason he would recommend the length
(23) of the bearings to be increased, where the pressure was increased so as to bring the pressure upon more particles and not increase the pressure on any one beyond a certain point.

The utility of the Locomotive Steam Engine was also discussed. He said that it would perform more than Wood had stated, that is, that the adhesion of the wheels gave them power to move more than 1/25 of the weight. He stated that on one of his most ill-constructed roads and with one of the first locomotive Engines that he made, he had moved 100 tons at the rate of 4-5 miles the hour. With an engine whose weight was about 7 tons, which, on the supposition that the friction is 1/100 of the weight, gives ½ a ton for the weight raised perpendicularly, or 1/14 of the weight is the adhesive power. The adhesion is best when the rail is very wet or very dry and clean, but in a bad state when, to use his expression, it is "greasy," or a slimy mixture of mud spread over the rail. He is about constructing a new engine at New Castle, which he considers will be superior to anything that has been made yet.

His explanation of the wheel being so much impeded by the mud is that in the after part of the wheel, where the rim is just leaving the track, the mud collects as a kind of wedge, & as the rim leaves the track a partial vacuum is produced and thus the pressure of the atmosphere acts to oppose the rising motion of that part of the wheel. He gave an explanation of the removal of the locomotive Engines from the Hetton Road. He had been employed on that road and had made all of the plans and arrangements for overcoming the height, &c. His son
(24) was desirous of being the chief Agent on the road, but the maneuvers of a Mr. Smith succeeded in obtaining for himself the situation. The result of the contest was a good deal of ill will between the parties. And when a new Engineer was appointed in the interest of Mr. Smith, their great desire was to do away as much as possible with the work and plans of Mr. Stephenson, their predecessors. Accordingly, these locomotive Engines were removed and stationary ones substituted in their place. According to information through Mr. Stephenson (to be seen an interested party) the cost of the Stationary Engine was £7000 and locomotives £1500. And it is found that less work at a greater cost is done by the Stationary Engines. When I visit that place I will endeavor to obtain a statement on the other side. A variety of other conversation passed, all of an interesting character. Mr. Stephenson invited me to accompany him through the line of the Liverpool & Manchester Rail Road, which I most gladly accepted. About 9 in the evening I accompanied him down to the Stage Office and engaged us seats for Bolton and then each of us returned to our respective places of residence.

Friday, February 22.

At 20 min. past 6 I was ready to go to the coach office and fearing to lose my passage I went without partaking of the excellent breakfast that Joseph, the waiter, had prepared for me. It was well that I did so, for the distance was a mile and a moment later I would have been
(25) left behind. By previous arrangement Mr. Stephenson was to be taken up by the coach about 1 mile from the starting place. I took my seat for the first time on top of a coach and at another time I will describe the mode of travelling which is not unpleasant. At the expected place Mr. Stephenson took his seat and in about 3 hours we set down at Bolton, about 32 miles from Liverpool. From this place to Leigh is a rail road constructing under the direction of Mr. Stephenson. It is 7 miles in length. After making a hearty breakfast we proceeded to the line of the Bolton road and walked over near its whole length, and after examining it, turned into the turnpike and walked on towards Newton. A coach overtaking us, we obtained a ride to that place. At Newton we stayed all night and the next day commenced our survey of the Liverpool & Manchester Road. From Newton in the morning we went about 2½ miles over a part of the line, and returned again to Newton. From Newton we again took the direction towards Liverpool. We followed the line as long as the walk was going on. On leaving the line, we bent our steps toward the village of St. Helen and there waited for the stage.

After waiting some time the stage came up and passed the inn before we had time to get to the door. Our next step was to take to the turnpike and make the best of our way to Liverpool, with the hope of being soon overtaken, and taken up by a coach, but our hopes were disappointed and we had to foot it all the way, making a walk of twenty-five
(26) miles, in one day. I reached Mr. Brown's almost entirely jaded out. Some refreshment was indeed very acceptable. I have hurried over the proceedings of these two days because I have not time for the description of the country, towns, collieries, &c. that we passed through. I could fill many pages with the incidents and scenery of these two days excursion. I defer it, too, in order that I may note down the information that I received from the explanations and observations of Mr. Stephenson.

The Liverpool & Manchester line proceeds from Liverpool to Manchester on nearly a direct line. Much heavy work is to be done in order to bring the line as near to a level as possible. The quantity of excavation is great and the Embankments are equally so. One of the Embankments is of very great extent. It is where the Rail Road crosses the Tankey Valley. An Embankment is brought up on both sides to where the Arches commence that cross the deeper part of the valley. The Act of Parliament requires that the height between the under side of the Arch and the top water of the Tankey canal would be 60 feet. This compels them to keep the line of road elevated to a great height. 9 Arches therefore are used of 50 feet span, with piers of 40 feet high are used, and the embankment is brought up to the abutments on each side. Foundations for the Abutments are going on and a considerable part of the embankment is made. The work already assumes a stupen-
(27) dous appearance and when completed will be one of the greatest curiosities in the Kingdom.

The section and plan of the rail will be seen among my plans. The method of laying the road is very simple. In excavating, when the earth is removed to the proper depth, from 6 to 12 inches of broken stone, gravel or sand, according as either material is most convenient, is laid upon the road and pounded down solid. Upon this stratum, which is called "ballast," the stone is firmly bedded, the chair that supports the rail having been previously pinned to the stone. The stone is so placed as to give a little inclination of the upper surface of the rail inwards to correspond with the conical shape of the rim of the wheel. This however is not well done. The upper surface is not placed in this situation in one case out of a dozen. The plan of fastening the rail to the chair is easily seen by reference to the drawing of them. The rail weighs 35 lbs. per yard and chairs 12 lb. each. Mr. Hartley proposes a new arrangement of the material of the rail of which I shall note hereafter. The L. & M. rail is permanently bent by a load of 7 tons on the middle. By contract the rails furnished are to be subjected to a test of 18 tons rolling over them at 2½ miles per hour, supported by four wheels. The wagons are to carry 2 tons to 2½, and will weigh 1 ton each. The wheels & axles will be seen among the plans. Stephenson denies altogether the exfoliation of the malleable iron rail. He has seen them much

and considers them decidedly superior to the cast iron. This opinion has the greater weight, as Mr. S. was a patentee of a cast Iron Rail,
(28) and still recommends and uses the malleable iron rails of 15 feet length. He thinks that the present rails will be in safe working condition 60 or 70 years, and the remainder of the rail will (be) valuable as a malleable iron, since age improves malleable iron very much. When the road is levelled ready for the stone supports, he considers that . . . on a day's work for 4 men. In speaking of curvature on the road they spoke of 4 or 5 feet in a chain as being the limit and that that should be avoided as much as possible. Where the curve is rapid the rail is bent by a wooden mall to the right shape. And when the curvature is considerable he recommends that the outside rail should be raised enough to throw an additional pressure on the inside rail, and thereby produce a uniform motion, by having the greater pressure upon the slower motion.

I made enquiries as to the superiority of the fixed or revolving axles. Upon the L. & M. Road he has adopted the revolving axle. Its advantages are first, it has a much more uniform motion and is much less liable to get out of order. Another is that one wheel meeting with an obstacle the carriage is less likely to be thrown off the rail, for the same obstacle which checks one wheel also, by means of the axle, checks the other; and, if the other tries to fly round, the point of the obstacle being the center, it won't move round by slipping on the rail; but in the case of fixed axles, one wheel being stopped there is the same tendency to fly round, and the other wheel enabling it to roll round easily the waggon will be much more likely to run off the rail when the mo-
(29) tion is great. When the axle is fixed, the flanges should be on the outside according to Mr. Stephenson's judgment. His reason is that the flange of the wheel farthest from the obstacle has much more power to check the motion with than the near one. If the road be very curved the axles should be fixed. When the axles are fixed the bearings should be 12 inches each. The upper side of the axle is flattened to make reservoirs for the oil, to keep the wheel constantly fed with it. It is proposed on this road to travel at the rate of 8 to 10 miles per hour. Locomotives & Stationary Engines are to be employed. A sketch of a Stationary Engine on the Bolton Road will be found among my drawings, it is, according to Mr. S., a 10 horse power. Length of stroke 3 feet. Diam. Cyl. 18 in. Steam 30 lbs. to the inch. Friction of Engine 4 lbs. per sq. inch. 28 strokes per minute. Of the 30 lbs. per inch indicated by the gauge only 20 lbs. should be considered, according to Mr. S., as effective pressure on the piston. In speaking of the Locomotive Engines, he said that in estimating the power 7 or 8 pounds should be allowed for friction of the working parts of the Engine. If the gage showed 50 lbs., not more than 40 lbs. should be considered as the pressure on the piston. In locomotive engines he found some inconvenience from the 6 wheeled carriage. The center wheels were allowed some play which produced a wobbling motion. On his road he thinks that 10 to 12 lb. will be required to draw one ton on waggons, diameter (of wheels) 3 feet, axles 3 inches. When he has to make the road over embankments he,

in the first place, lays down wooden sleepers across the road, the
(30) dimensions of which are 9 feet long, 6 in. broad, 4 or 5 thick.

These are preferred in consequence of the timber all sinking together and because the timber is more easily raised again to the proper level. From Liverpool to Manchester is 50 miles by canal navigation and 31 miles by the Rail Road.

The cost of transportation by canal is 10/ to 15/ per ton including freight tolls, &c., &c. On the Rail Road the price is intended to be put at 5/ per ton.

At a place where he crosses a road and stream he has 3 arches, each 30 feet Semi circle. Piers 8 feet thick, 30 to 40 high. Arch stone 2 feet. Principally of Brickwork, the quoins & face stone only of stone. Batter at the sides 1½ in. to the foot. He has the Brickwork laid up at 2/ per cub. yard. Brick and lime found. The masons are supposed to have a good bargain. Bricklayers are paid 4/ per day. Common labourers 2/6, each finding themselves. In speaking of comparative advantage of level road and ascent he would prefer overrunning an ascent of 100 feet and descending, rather than go one mile further round on a level road. He says the expense of fixed and revolving axles will not differ much. Axles 35/ per cwt. Wheels 18/ per cwt. Both furnished in perfect working order, rims case hardened and bearings fitted up in the most perfect manner. Rails are to be put down 4 feet 8 in. apart from inside to inside. Passing places cross the line in 45 feet. May do it in less distance.

The road consists of two tracks, but the two inside rails are laid at the same distance apart as the other pairs, so that on coming to a bridge the waggon that has bulky load may, by means of a passing
(31) place, take the centre road and pass easily through the bridge.

In speaking of one rail road, he thought the plan objectionable inasmuch as the rail would by the pressure be forced into the wood and the motion of the carriage combined with the yielding of the wood in his opinion would produce a waving motion to the iron, which would tend to draw out the screws and eventually loosen the rail. And, moreover, the carriage would always be working up hill and of course do less work than on a more permanent rail.

He thought that the soaking of the wood by rain and wet weather likely to increase the difficulty in these respects. The wheels for the waggons are cast with the rims solid, but at the nave there are three breaks which, when the metal has cooled, is filled up with malleable iron wedges. A greater part of the embankment is done by waggons moving on temporary rail ways laid down for the purpose. Embankment is carried in this way a mile for 6 d. per cubic yd. when the material is good and as the material is harder the price increases. In the management of the Engineer Department much the same system is pursued as with us. He has three assistant Resident Engineers stationed on the line and, once a week, he goes through the line and advises them how to proceed. The mode of leveling is the same as ours, but they do not measure as accurately as we do. The work is done in a mixed way,

some by contract and some by day's work. There appears to be
(32) a want of accurate information as to the cost of doing several
kinds of work. And when a contract was let, it is their practice to keep an accurate account of the work done, time, &c., in order to determine whether they are giving too much or too little, and they seem to have the power of doing pretty much as they please with their contractors, who are with them only a promoted labourer.

Sunday (Feb. 24th)

I went to the Unitarian Chapel in company with Mr. Stephenson and listened to one of the most solemn and impressive speakers I ever heard. His sermon was a good, practical one, without any great pretensions to eloquence or logic. But his manner impressed one as it ought to do with the solemn affair which he was performing and the audience seemed duly sensible of it, for a more devout and attentive an assemblage I never sat amongst. The church has a pretty outside and is neat enough on the inside, but no ways remarkable.

At ½ past 2 Mr. Brown and myself went in the carriage to dine with Mr. Hartley. A party of 8 or 10 dined with us and quite a pleasant time was spent in their company.

Monday (Feb. 25th)

This morning was spent in making out some plans and procuring some notes of plans at the Rail Way office. At 5 o'clock quite a party assembled at Mr. Brown's at dinner, and I had the good fortune (thanks to the kindness of Mr. B.) to be seated next to Mr. Stephenson, and next
to him sat Mr. Hartley. Mr. Hartley, as he sat down, observed
(33) to Mr. Stephenson that he must be on the lookout as he sat be-
tween a Yorkshire man and a Yankee, he was in a dangerous predicament. A variety of pleasant conversation passed, but not much of it such as is worth the time of putting it down. Among the rest I introduced the subject of the discovery of the Gas lamp. I enquired of Mr. Stephenson the origin of his discovery. He stated that he had observed that when a number of candles were held to the windward of the place where some of the hydrogen gas was burning, as it issued from the crevices of the rock the flame of the burning gas diminished and, by increasing the number of lamps, the gas flame almost disappeared. He explained the Phenomena by saying that the oxygen was all consumed by the candles before it reached the gas flame, the supporter of combustion being therefore cut off, the flame must go out.

Tuesday (Feb. 26th)

All today has been spent in drawing plans of the machinery and in writing. In the Afternoon I went with Mr. Brown to the Steam Factory of Mr. Fawcett. The works are very extensive but they did not take us all through them. I imagine that they had as leave not exhibit them to an American, particularly if they think he has any information on theory of Steam Engines. I saw of pair of marine Engines of 60 horse

power each. They did not appear of as good an arrangement as
(34) the Engines of the N. American. We saw them make some large
castings, but their manner of doing it was in no respect superior to that practiced by us. The consumption of iron is about 10 tons per week.

Wednesday, February 27.

This morning agreeable to previous arrangement I accompanied Mr. Stephenson through the parts of the tunnel now excavated. The tunnel runs under the town. The total length is about 21½ hundred yards. The declination or depression is 1 in 50. The dimensions are 22 feet high, 16 feet wide. The arch is a semi-circle; a great proportion is cut through solid rock. When the rock becomes shelly and not likely to stand well, they use brick arches from 2 to 2½ brick in depth. When the rock is to be excavated, they carry the top of the tunnel on first, and then dig trenches on the side, and the centre material is blasted or picked according as the stone requires. The excavated material is carried to the shafts on rail ways by horse power, and there is raised through the shaft by horse power. It is done by contract. The contractor is furnished with the rails and timber to lay them on, and with machinery at the shaft for raising the buckets. He finds all the labour of putting down the rails, finds his own tools, lights, &c., horses, powder, and receives 4/ per cubic yard.

Mr. S. considers that the contractor has an excellent bargain. He (the contractor) has to remove it from the mouth of the tunnel, not over 50 yards, and the greatest distance in the tunnel 400 to 500 yards. Two gangs are employed and the work driven night and day. When the
brick arch is built, a centre about 11 feet high and full width
(35) is kept close up to the excavation; when the excavation is of a
loose character, the arch is carried on every 18 inches of the excavation, so that at no time the tunnel is more than two feet ahead of the brickwork. In places where the material passed through is of a firmer texture, they work 2, 3, 4, and even more feet ahead of the brick work. They commence the arch at the sides and build it nearly to the crown from the inside of the centering and when the arch is complete, bricks and pieces of stone are rammed in above the arch to make all solid between the arch and the rock or clay above. The materials for the arch are delivered to the contractor at the mouth of the shaft and he conveys them into the tunnel and builds the arch for 3/ per sq. yard of inside surface of the arch—considered a fair bargain. The shafts that descend are from 40 to 70 feet deep, composed of brick segments of 1½ brick built 10 feet by 6. The versed sine on the 10 feet side is about 10 inches or a foot. Some of the shafts go through solid rock and no arching is necessary. The mechanism for raising the materials is similar to the horse gin described by Strickland. Stables, etc., are provided for the horses below in the tunnel and the ventilation is carried on by wooden boxes 8 x 8 which convey the air through the tunnel. They have connected the pieces of tunnel, driven in different directions from two adjacent shafts, and in some places have differered not at all

from the straight line and in greatest variation not more than 2 or 3 inches. This shows great accuracy in the laying out of the work.
(36) It is managed by means of the compass. The situation of the shafts was in the first place determined by observation from the tops of buildings that commanded a view of the several shafts. The level is preserved by the spirit level, and the top or underside of the crown of the arch is the working line. The direction is preserved by the range of plumb lines let fall from points previously determined to be right. Where the Brick work and the Stone join, the bricks are let into the rock, making a straight joint and being on the same line as the rock surface. The brick work is commenced at various heights, according as the work requires. Sometimes only little patches 2 or 3 feet wide are put. In fact, whenever they find rock of a soft texture and think brick better, they cut away the rock until they get into a more firm surface and, leaving a square face to the stone, fill it with brick work.

When they wish the greatest strength of arch, it not contracting as much as mortar, and therefore leaving the arch more durable. The rock is throughout of sufficient firmness not to require an inverted arch to spring the brick work from. The brick work sometimes commences below the level of the road, and above it at various heights almost to the crown of the arch. The work was commenced about 15 months since, and it is expected to be completed in June. So that I hope for a walk through it. It is now more than half done and is expected to cost rising of 60,000 pounds. At the bottom of the tunnel commences a curve of 9 inches to the chain, which is the most rapid curvature on the whole line.

Thursday, February 28, 1828.

(37) This morning has been spent in examining the iron works of Brown, Logan & Company. They are principally devoted to the manufacture of Chain Cables, of which highly useful species of cable they are the originators, and in the making of which they have attained to a great perfection. There arose at their introduction a severe contest between them and the Hemp cable manufacturers, as to the relative advantages and strength of the two species, in which Brown, Logan & Company have completely carried the day. The iron is brought to them rolled to the size that they wish and the chains made by them. Each workman is paid by the number of links which he makes and if, in the proving of the chain, a link does not bear the standard proof, the workman has to repair for nothing, and is fined ½ crown into the bargain.

After examining into the process of bending, cutting, welding the link in a shop where there were 12 forges at work, we went into the department appropriated to the proving of the chain. A reference to the drawing will make the proving process very plain indeed. The power is obtained by means of wheels and pinions. A crank of two feet radius is turned by 4 men. A pinion on this same axle drives a wheel of 5 feet diameter. A pinion on the second axle drives a wheel of
(38) 5 ft. diameter; a pinion on the 3rd axle, 8 inches in diameter, drives a wheel of 6 feet diameter, and around the axle of the 6 foot wheel, the chain that communicates the power to the chain to be

proved is rolled, making the point to which the power is applied about one foot from the centre of the last axle. The actual strain that the chain sustains is determined by a compound lever.

The chain strains upon a heavy shaft at about 8 inches from the centre. Attached to the same shaft is a lever of 12 feet long. At the end of the 12 feet it acts upon the short arm of another lever 1 foot in length, the long arm of the second lever is 9½ feet and at the 9½ feet point the weight is placed. Of course one pound acting at the 9½ feet point will just balance 200 pounds acting at the other end of the compound lever. A piece of 1½ inch iron was put in. The iron could plainly be seen to elongate as the weight increased and the section grew smaller. It broke short off with a bright metallic lustre. It was not considered a good sample from breaking short off. The second was a piece of 1½ inch iron which broke with 27½ tons, the dimunition of diameter was to 1 inch still keeping its cylindrical form or rather getting into a conical one. 3rd piece 1⅛ broke with 21⅛ tons. 4th piece 1 inch diameter broke with 16¾ tons. There was a very sensible degree of heat occasioned by the stretching of the iron.

(39) Mr. Logan stated that there was very little elasticity to iron as it would not return to its original situation, when slightly stretched. Mr. Logan also stated that iron will not increase in strength exactly in proportion to its section. He found that as the section increases the strength does not increase quite as fast. He attributes the cause of the difference to the manufacture of the bar. He thinks the process of rolling is more favorable to consolidating the particles in small bars than in large ones. Thus there is more pressure and power applied to the small bars in proportion to their areas of section than the large ones. The point weakest in a link is just in the turn at A. He attributes the greater weakness there to the unique strain that the iron receives, the outside fibres are strained sooner than the inside, and, of course, the whole strain is brought upon fewer fibres. If a chain with a stay should be made of a given sized iron bar, the strength of the chain to the strength of the bar of which it was made is, according to Mr. Logan, 12:7. The relative prices of chains from ½ to 1 inch will be found in Mr. Logan's memorandum. The remainder of the day was spent in writing letters, making plans, &c.

Friday 29th, Feb.

(40) This morning after accompanying Mr. Brown to several iron manufacturers and making some enquiries respecting bars, &c., I went again to Mr. Hartley's office and there took a copy of the Liverpool and Manchester Rail. Mr. Hartley does not entirely agree with Mr. Stephenson as to the form of the malleable iron used. He would prefer the same quality of material in a different shape, that is, the edges parallel, as below.

(Sketch, page 40)

His reasons are that though curved longitudinal section is by theory the best arrangement for any given quantity of material, yet in the manufacture of the bar there is inferior work in consequence of the

bar's being passed through the rollers only once. The iron, therefore, is not so consolidated and has many more imperfections on the surface, than it would have could the process be repeated; now with the bars of a uniform section throughout, they may be pressed through a great number of rollers and the greatest possible advantage taken of consolidation of the material and arrangement of the particles from rolling down from one size to another. Another advantage of bars of a
(41) uniform section is that the supports or chairs are not confined to any particular distance apart and may be placed to best convenience. As for instance, in passing a road it would be very desirable to place the chairs on 8 or 12 inches apart and thereby make a much more secure rail. Or if a rail is found defective or weak, the support may remedy the defect and provide for the weakness. The less expense of the rails is another important advantage. Another one that occurs to me that when the rail is weakened by rust and abrasion, the iron can be converted into other bars of ordinary shape with great facility and therefore be more valuable. Mr. Hartley is about having some rails made according to his views, and I shall endeavor to obtain a draught of the rail, an account of its strength, cost, &c. I consulted Mr. Hartley on the subject of the ends of our rails. He considers that square joint would be as good as any, but he spoke in a way that showed he had not considered the subject with much care.

I was prevented from making many enquiries that I intended by Mr. Thomas, the Engineer of the Dublin Works. I was introduced to him by Mr. Hartley, and received a friendly invitation of visiting his works near Dublin, which I shall probably accept and gain what information I can at that place. Returning home I made out my
(42) plans and section of the rail, chair, wheel & axle to be used on the Liverpool & Manchester Road. On the subject of the wheel and axle I expect more definite information when I visit Newcastle where the works of Mr. G. Stephenson are located. At ½ past 5 I accompanied Mr. Brown to Mr. Thomas Bolton, who had invited us to dine with him. I found quite a large party assembled, principally elderly men and, as Mr. Brown informed me, mostly Radicals. We sat down to the table at about 6 o'clock, twenty in number. His worship, the Mayor, did us the honour to dine with us. We also had the pleasure of the company of Mr. Shepherd, whose name is seen so much in the papers at present. The Mayor sat at Mr. Bolton's right hand and Mr. Shepherd at his left and next to Mr. Shepherd I was seated. His worship was attended by his own servant, was a fine looking man, in an elegant livery of Brown & Gold. Small clothes, silk stockings, &c., &c., &c. Several gold bands and chains about his shoulders and person gave a rich effect to his appearance. The dinner was served up in handsome style, and among other dishes was one of new potatoes, raised probably in a hot house. They were, however, inferior to the ones of the growth of last season. I found his worship quite a pleasant, unassuming gentleman, and did me honor of partaking wine with me. With the
(43) exception of Mr. Brown and the Mayor the gentlemen were Radicals, and the principal topics of conversation were political and some rather sharp shouting passed between Mr. Shepherd and a Dr.

Crumpton on the subject of some handbills that between them had been published respecting Mr. Harkisson previous to the late election. They both appeared as blamed of the act and to be desirous to throw the odium on each other's shoulders. I was somewhat surprised at the language & manner of Dr. Crumpton. They were certainly such as no gentleman should allow at his table. From the table we adjourned to the drawing room upstairs, where cards soon engrossed the attention of everyone; some clergymen, who were of the party, not excepted. It appears to be quite a common thing for divines in this country to partake of the amusement derived from cards; whether they play for money I know not. After some interesting conversation with Mr. Brown and some gentlemen on the subjects of charities, Dispensary, &c., we made an early retreat.

Saturday, March 1st.

The principal part of this day was occupied in writing and drawing & making preparations for going into Staffordshire, South Wales, and to Brocton. Some letters also to friends on the other side of the water were hurried through.

Sunday, March 2nd.

(44) This morning in company with Mr. Brown and family, I went to St. George's Church. It is the resort of all the fashionables of the town, and the Mayor has his pew there in great state. The inside of the church is good size but not very large. The galleries and roof supported by Corinthian Pillars, the Capitals of which and the Entablatures resting on them were extremely richly executed. On each side of the door of the Mayor's seat a pedestal iron railing about 3 feet high is surmounted by a gold eagle and the inside of the pew finished of a great splendour. We were fortunate in getting a good seat, where we had a full view of the entrance of his worship. He was preceded by quite a procession. First came two mace bearers, bearing each a mace about 3 feet long, and kept in high polish; next came a man carrying a sword with a rich gold and velvet scabbard about 4 feet long. He was followed by a person carrying a gold or gilded mace about 4 feet long and of a larger size than the silver ones, and after the gold mace came one bearing I know not what—I was going to say a "puddling stick," elegant gilt, for it looked more like that (than) anything that I could bring to mind. It was about 3½ feet, with a round handle, the end widened and flattened and made rather hollowing.

Next walked the verger in his black silk gown and opened
(45) the pew door for the august personage that followed him. It was the Mayor himself, with a black robe on and bearing a white wand about 4 feet long. As the men bearing the maces, &c., approached the pew, they arranged the maces, swords, puddling stick, &c. on each side of the door about the iron pedestal, and the Mayor, before, he entered, placed his white wand among them and then took his seat with all due dignity. I could not help contrasting the scene that I looked on with the one that I was present at, in Baltimore. The President of

the United States came into church in his plain suit of black and took his seat without the least pomp or ceremony and, had I not known him by sight, I should never have noticed that so important a servant of the public was present. The recollection produced a most contrast (to) our way of doing things and the manner that is here considered necessary to keep up the respect and dignity of persons in government. The service was much the same as ours except that the congregation did not join in the responses audibly as with us, and the chanting was more used. They even chanted one of the Collects or prayers. The congregation were very attentive and appeared seriously impressed with the duties that they were performing. A favourite clergyman, as was said, preached us a very ordinary sermon on bearing false witness, perjury, &c.
(46) His manner was constrained and monotonous, his matter and style commonplace and destitute either of force or imagination or persuasion.

After service the Mayor left the church in the same pomp and ceremony as he entered and entered his state coach in great style. Coachmen and footmen dressed in Brown & Gold. Chapeau a bras with a fusion of gold lace about them. His worship having retired, the remainder of the congregation were at liberty to go out. I can say but little for either the beauty or elegant appearance of the assemblage of fashionables which the church was said to contain. They are most decidly inferior in both respects to the world with us. But in a more important point I must yield them the superiority. When they entered the church and during service I would say that there was more devotional appearance and demeanor, a more respectful attention to the service, than I think would be met with, in the same class of people with us. In the afternoon I dined with Mr. Shipley, one of the partners of the house of W. & I. Brown & Co. I find that visiting on Sunday, dinner parties, &c., are much more common than with us.

Monday, March 3rd

(47) Today I was by previous arrangement to leave Liverpool and go to Ruabon, about 35 miles from Liverpool. As I could not get away at the hour when the coaches left, Mr. McGregor, the proprietor, and myself took a post chaise from Birkenhead, opposite Liverpool, accordingly, having packed the articles that I wanted in a small portmanteau, I bade adieu for the present to the friendly circle at Mr. Brown's and having obtained some letters from Mr. Brown at his counting house left him, with good wishes, and joined Mr. McGregor in the car that was to take us down to the Steamboat that carried us over the Mersey to Birkenhead, As we crossed we had a fine view of the town. The appearance of the shipping in there was striking; the yards were all braced into the slantposition, making a v-angle with the mast, in order to take up as little room as possible. It was a pleasing scene. Through the town be very prominent points of beauty; the style of building, with shipping and steeples reminded me of New York. The river was crowded with small craft and several steamers were seen to be in motion in many directions. They are compelled to make the

steam vessels for a good deal of rough weather and of course have not that gay, beautiful appearance that ours have. The ferry boat which was a steamer was in every respect inferior to the boats employed
(48) for a similar purpose at New York. At Birkenhead, we soon were provided with a post chaise and commenced our journey towards Chester. I found the traveling by post chaise extremely pleasant, though rather expensive. A post chaise is a vehicle mounted upon 4 wheels, with a body like a closed carriage except that the front seat is, as it were, set up, and the room made thereby for the high seat of the driver. It has large windows in front and one on each side, and a small one at the back; so that it gives us an opportunity to see extremely well. The rate of travelling was about 9 miles the hour. The roads were very good, upon the McAdams plan and made the motion of the carriage consequently easy and pleasant.

The country through which we passed appeared to be in fine cultivation and even at this season clothed with a most beautiful coat of green grass. The houses generally have a very antiquated appearance, and were generally destitute of that air of neatness and comfort that we meet with in America. Many of them were evidently many hundred years old and their occupants appeared almost coeval with them. We passed through clusters of them every mile or two, and the same ancient, clumsy, illcontrived style of architecture and arrangement of building prevailed. The country appeared most beautiful. We passed the lovely Mansions of many a proud aristocrat and among others the
(49) mansion of the Earl of Gloucester, who is said to be the richest commoner in England. Several of the yards and lawns exceeded in beauty anything that I have ever seen, as regards the verdure and evenness of the surface and the extension of the grass.

March 15

From March the 3rd until this day I have been so occupied that all attention to journalism was out of the question. On the 3 I continued my journey from Liverpool to Ruabon, passing through a most delightful country. At about 3 we reached the ancient City of Chester, having passed through the villages of Earlham, Sutton and Blackford. The City of Chester is one of the oldest in this part of the country. It was once a walled city and we entered it through a gateway evidently of great age. There is nothing interesting about the place excepting that which is derived from its antiquity. Streets narrow, dirty and uncomfortable, houses of the most singular, antique appearance, and the population apparently not out of place or dissimilar from the city that they inhabit. From Chester, after a tolerable dinner for which I was charged one dollar, I proceeded by post chaise to Wrexham, passing several prettily situated villages but most of them composed of old-fashioned, uncomfortable buildings. From
(50) some of the hills on the road I obtained some most beautiful views. One in particular, which took the City of Chester in the distance together with several villages, churches, gentlemen's seats all

scattered over as extensive surface of the most beautiful verdure that can be conceived. We reached Wrexham about 5 and posting on to Ruabon immediately. In going into Wales the surface of the country became more and more undulating and of not that opulent fertility that I have previously noticed. The country people both male and female exhibited the reddest cheeks that I have ever seen. Some of the girls were quite pretty. I stayed all night at Ruabon at the house of a Mr. John Allen.

Tuesday

This morning I visited the Ruabon works and gave them a description of the kind of rail that I wanted, and at 10 left Ruabon for Overton bridge where I met the Coach and proceeded with it to Shrewsbury. The country that I passed over today was all in a state of good cultivation, the surface not very even, and the soil only tolerably fertile. Many pretty views were held on the road. Two or three very splendid
(51) seats of noblemen enriched the landscape very much. About
dusk I reached Shrewsbury. Here I met by appointment Mr. Haywood, of Liverpool, who is to act as my chaperon in the iron manufacturing district that I am about to visit. He proposed posting on to Priorsleigh the residence of a friend of his, Mr. Horton, and accordingly on we went and reached his mansion about 9 in the evening. We were very hospitably received by the lady of the house, her husband being out, and when he returned about 10 he renewed the welcome in a manner that showed that Mr. Haywood was an old friend. After partaking of the best glass of ale that I have ever drunk we retired to bed.

Wednesday

We took an early walk around the grounds of Mr. Horton. His residence is a fine, large building, situated upon an elevated spot and commanding a view of the country to a considerable extent. His lawn is very extensive and kept in beautiful order and ornamented with walks and some fine old trees. After breakfast Mr. H. & myself mounted a couple of his horses and visited the several iron works in the neighborhood. On our return we went through the China manufactory at Coalport. We there saw the process throughout. The clay is
(52) first worked to a proper consistency and then moulded on a
wheel by the hands of the workmen to the shape that is required. From his hands it comes with the sides considerably thicker than we find the cups to be. After being shaped it is set away to dry. When dry, a 2nd workman takes and in a lathe turns it down to the proper shape. It is next sent to the oven and then baked. From the oven it passes after it is cooled to the hands of girls who brush it and then dip it in a liquid which produces the glazing; after the dipping it is again exposed to the heat of the oven, being removed a 2nd time from the oven, it is taken to the printers who print upon the surface the outlines of flowers, figures, &c., that we see on china. The operation is

performed by a kind of engraving. Upon a copper plate the figure is engraved. This plate is covered with a kind of wax, which melts easily and cools quickly. After the plate is warmed and covered with the composition, the surface of the plate is cleaned by a sharp, straight edged knife, which leaves all engraving outlines filled with wax; a soft kind of paper is then spread on the copper plate, and being

(53) warmed, when the paper is removed, the traces of wax are left on the paper. This paper is then fitted nicely to the cup, etc., and the cup warmed and then the paper removed leaving a faint but distinct outline of the different parts of the figure intended to be painted. From the printing apartment it goes to the painting room. Here we found some 20 or 30 quite prettylooking girls employed in painting, each one putting on one colour, so that figures which require 5 or 6 different colours in painting alone passed through 5 or 6 different hands. From the painting room it goes again to the oven and after coming out the 3rd time goes into the hands of the burnishers, who brighten the gold & from here it goes into the hands of the warehouse men. From his to the packers, from his to shippers, from his to the china merchants, from his to the retailers, from his to the buyers, from his to the breakers, and from his it descends again into its original earth. After returning to Mr. Hortons and taking a lunch, and some of his good ale, we made the rest of our way to Wolverhampton, where we spent the night after first paying a visit to a little theatre in that place and saw some decent acting.

Thursday

(54) This morning after calling on some Iron Masters in the neighborhood of Wolverhampton, I took post chaise to Dudley, visiting on the way there some large establishments for the manufacture of iron. I have now reached the heart of the iron district and a most dim scene did it present. Tall chimnies (from 100 to 200 feet high) belching forth flame & smoke in every direction. Steam engines without numbers. Around each establishment was a most filthy, little village inhabited by the families of the mechanics employed in the works. The machinery for mining coal, and the hills of rubbish taken from the mines, and of refuse from the works, met the eye on every quarter. The children were dirty and ragged in the extreme. The whole atmosphere was full of coal smoke and dust and hung like a cloud over the land. I suppose that within my view there were from 200 to 300 steam engines at work, the silvery, beautiful vapour from which presented a fine contrast with the dark volumes of coal smoke pouring out of the adjacent chimnies. I never witnessed a more striking instance of the many toiling for the few.

(55) Frequently after passing through a village of 2000 to 6000 inhabitants, all working for one establishment, receiving wages barely sufficient to keep body and soul together, and living in hovels that it was painful to consider the habitations of human beings, we would pass the princely residences of the proprietors, furnished and full with all that art could produce or money procure.

About noon we reached Dudley, which is another of the dirty towns of the iron manufacturing district. Here we passed a magnificent old ruin, formerly the residence of Lord Dudley's ancestors. As I hope for a more particular examination I shall say no more for the present. At Dudley I was introduced to Major Hawks, proprietor of extensive glass works, where the most finished glassware is made. The operation is similar to that practiced by us and the cutting & polishing done by steam power. From Dudley we went to Major Hawks' residence, about 3 miles from D. and took dinner with him and lady.

Friday, Saturday, Sunday

These three days were spent in Major Hawks' neighborhood, making his house our home. I visited some iron works in the neighborhood and also the seat of Lord Dudley, the assistant secretary for foreign affairs. The buildings were undergoing some extensive alterations.

(56) I was upon the whole disappointed with the interior of the building and the exterior was no extraordinary effort of architectural skill. The grounds were beautiful. Extensive lawns, with aged oaks, deer, etc., Which I have not time to describe. Major Hawks & lady entertained us with great hospitality and I promised myself the pleasure of again partaking of the pleasures of their table.

(no 57-58)

Monday

Today we made the rest of our way to Kidderminster, where we visited the establishment for the manufacture of tin plates.

Specifications for Coal Deposit & Yard

(59) Brickwork. Wall on north side of the yard to be carried eight feet high above the level of the rail on the loading place and all according to plans, to be laid in good lime and sand mortar.

Timber. All to be good . . . . timber. The bearing beams for the rails to lay upon to be 12 inches deep by 6 inches wide. The posts 12 inches by 6. The braces 8 inches by 4. Sills around the recess of oak timber 12 by 6, fastened down in workmanlike way.

Pedestal of Kentish . . . 18 inches long and 12 inches wide and 10 inches thick (one for each deposit).

Estimate for Coal Deposit

Timber, 2064 cub. feet. Norway pine including supporting posts, joists & stretchers at each 12 feet. 358 cub. feet—40 beams 8 inches by 4, or 64 cubic ft. Total 2484 cub. feet at 3/3, 403.13.

Foot boards along rail, 11 in. wide by 3 in. thick.

27 Rows of Brickwork at £10.4 per row.

(60) On Thursday evening, April 17, I arrived at Newcastle and, after attending to my lodgings, I called on Mr. R. Ste. in the evening but, not having the pleasure of meeting him, left my card. On the following morning he called on me and our first visit was to his

factory, where we found his men employed fitting up his new engine and preparing wheels. As I shall have an opportunity of preparing a more detailed view of the engine I defer it till then.

There were many moulds laid in the sand for the rail road wheel; all that appears to be difficult in casting this wheel is that the rapid cooling of the outside breaks the spokes from the hub. The mould is made in this way. A cast iron mould is prepared for the outside and the forms for the spokes, &c., are made in the sand. The cast iron is about 4 in. thick and the inside turned to a great degree of smoothness.

(Sketch, page 60)

By admitting the breaks in the middle all difficulty of making this chilled wheel ceases. After the wheel is cast, wrought iron plugs are put in & the hub turned out without putting in a box or anything of the kind.

(61) The Liverpool and Manchester Rail Road extends from Liverpool to Manchester, distance . . . .

Its sections are as follows.

Commences with the tunnel level 0.25.

Ascends the inclined plane in tunnel at ¾ in 36, or 1 in 48.

Sec.	Length	Rise	Fall	Inclination	
1	212 yds.	0	0	Level	Entering and in the tunnel
2	1998 yds.	500	—	¾ to 1 yd. or 1 in 48	In tunnel Straight
3	5½ miles	0	126	4 ft. 10 in. to mile. 1 in 1052	
4	1½ miles	82.5	0	⅜ to 1 yd. 1 in 96	
5	2 miles	0	0	Level	
6	1½ miles	0	82.5	⅜ to 1 yd. 1 in 96	
7	2 miles	0	0	Level	
8	6 miles	36			

Sec	Length Miles	Yds	Rise	Fall	Inclination
1		212	—	—	Level Entering & in the tunnel
2	1	238	125		¾ to yd. In tunnel, perfectly straight or 1 in 48
3	5½		—	26.57	4 ft. 10 to mile. 1 in 1093
4	1½		82.5		⅜ to yd. 1 in 96
5	2		—	—	Level
6	1½		—	82.5	⅜ to yd. 1 in 96
7	1½		—	4.5	3 ft. per mile. 1 in 1760
8	1		—	—	Level To well over Tankey Via't.
9	6		—	36.	6 ft. per mile To Chat Moss. 1 in 880
10	5		20	—	4 ft. per mile over Chat Moss. 1 in 1320
11	5½		—	—	Level To Manchester
	30½	450	227	139.5	
	30¾ miles		139.5		
			87.5 diff. of level		

(62) On Section 2 the power is to be 2 40-horse engines to be communicated by an endless chain passing over pullies or sheeves at the bottom and top. On sections 4 and 6, two 40-horse engines each. One engine is considered sufficient to do the work, but to avoid delay and give an opportunity to repair accidents two engines are to be placed at the head of the planes 2, 4 and 6.

The moving power for the remainder of the road is to be Locomotive engines, which are to travel the whole length of the line from the head of the tunnel to Manchester. They are intended to travel at the rate of from 8 to 10 miles per hour and draw 20 tons of actual load of merchandise. The inclined planes are to be worked by ropes. The rope of the tunnel plane to be 5½ in circumference. On the planes 4 and 6, where the inclination is 1 in 96, a rope of 4½ to 5 inches.

The dimensions of the rails are 1½ inches rolling surface and 15 feet long, supported every 3 feet on chairs of cast iron. The exact size and shape of rails will be seen by the plan. They weigh 35 lbs. to the yard and chairs weigh 12 lbs. each. The rail assumes a permanent alteration with a weight of 7 tons in its middle. The road is to consist of 2 tracks, 4 feet 8 inches from inside to inside. The manner of making consists in first bringing the surface to a proper level, either by excavation or embankment as the case may be. A stratum of broken stone is then laid over the road for a depth of from 6 to 12 inches,
(63) according to the nature of the foundation. Upon this bearing stratum (called ballast) the stone is placed that bears the iron chair. The foundation stone is from 1½ to 2 feet square by 8 to 12 inch. thick. The chair is usually fastened to the stone before it is brought to the spot where it is to be used. It is made secure to the stone by drilling two holes in the stone, then plugging them with wood and driving an iron pin through the iron into the wood. The stone with the chair on it is brought to the spot where it is to be used, and fixed in the proper situation and level by wedging it by small stones. This plan of construction appears to me the most defective part, inasmuch as it is almost impossible to wedge up the stone so as to give it a permanent solid bearing. The smaller stones will work loose. A better way of doing it would be, it appears to me, to settle down the broken stone stratum by a . . . pile, and place the stones on it when settled, and apply several more blows to it, to compel all the weaker points of support to give way and bring the stone to full and solid bearing. Then let the upper surface be prepared for the chair, and the holes made and the chair fastened. The chair and rail being laid down, the space between and around the rail is filled up with broken stone to the level with the top of the foundation stone. When the road is carried upon an embankment that it is supposed will settle considerably, the chairs are fastened to timbers laid across the road; the dimensions of the timber 9 feet by 6 in. by 5 in. The manner of turning out will be seen
(64) by reference to Plan No. . The rail branching out to cross reaches the other rail in 45 feet. Thus

(Sketch, page 64)

The greatest curvature of the road is at the bottom of the inclined plane, where the road is level and curves to a versed sine of 1 foot in a chain. Thus

(Sketch, page 64)

The greatest curvature of the road is on Chat Moss, where there is a curve ¼ of a mile long, with a versed sine of 3 inches to the chain, the inclination of the road being 4 feet to the mile.

(no pg. 65)

The waggons are to weigh about a ton, axle weight rather more. Wheels fastened to axles, 2 feet in diameter, 3 inch axles, bearing 8 inches, to carry from 2 to 2½ tons and go in trains of 10 to each locomotive engine of 8 to 10 horse power. The bearing surface of the wheel is 3½ inches. The other particulars of the wheel to be seen in Plan No. —. Mr. Stephenson thinks 10 to 12 pounds will move one ton on his road on a level and, as his axles are 3 in., and wheels 30, taking a mean of 11 lb., the resistance at axle will be 1/20 of weight. Wood makes it 1/17. If we take 12 lbs. we have 1/18.60 for the resistance at the axle, still more favourable than Wood. The waggons are connected by a chain from each side, as the plan shows. The usual plan has been to connect them by the centre, but Mr. S thinks it will be more
(66) advantageous to connect them from the ends of the timbers. If the flange be on the inside it tends in going around a curve to counteract the tangential tendency of the waggons.

(no 67)

(68) The facts of the Stockton & Darlington Rail Road.

Extends from Stockton upon Tees, passing within a mile of Darlington, to the collieries near West Auckland in the County of Durham. It is a single line of Edge Rails, originally intended to be of the cast iron Rail patented by Lock and Stephenson, but principally composed of malleable iron rail. It has turnout or passing places nearly every quarter of mile, in some places there is a ½ mile without any passing places. The passing places in length, after they clear the main road, is of a length to receive a train of carriages of from 24 to 30. The line winds considerably and the curvature varies from 1 to 12 inches in a chain. The bearing surface is 2 in. broad and the rails are 15 feet long and weigh 32 lbs. to the yard. They have used some 28 lbs. to the yard, but find that size too light for the locomotive engine. The rails are secured by means of cast iron chairs fastened to a foundation stone. The foundation stones are generally too small, being only from 8 to 12 in. broad and 1 foot long, by 8 to 10 inches deep.

(Table on Diary Page No. 69)

Length of Sections and the Grades on the Stockton & Darlington Rail Road

Sec.	Length*	Incli.	Ascent	Descent
1	92.82	1 in 104	59.98	
2	64	1 in 1584	2.66	
3	4	1 in 487	.5	
4	64.89	1 in 226	18.92	
5	2	level	level	
6	100	1 in 253	26.10	
7	167.52	1 in 2112	5.23	
8	18	1 in 713	1.52	
9	131	1 in 204	42.30	
10	129	1 in 1408	6.04	
11	140.2	1 in 1584	5.84	
12	16	1 in 396	2.66	
13	141	1 in 135	69.03	
14	81	1 in 352	15.18	
15	99	1 in 135	48.47	
16	180	1 in 528	22.50	
17	116	1 in 121	65.25	
18	73.5	1 in 144	33.27	
19	5	1 in 325	1.00	
20	37	1 in 31	78.62	
21	84.2	1 in 33½		132.15
22	28.4	1 in 576	32.5	
23	61.2	1 in 176	22.95	
24	99.3	1 in 31¾	206.4	
25	50.4	1 in 33		100.8
26	32.8	1 in 495	4.33	
	24.96 Miles			

(* While the unit of length is not shown, it is evidently the surveyor's chain of 66 ft. Editor.)

On the embankment timber is used to support the chairs. The timber 5 or 6 by 4 or 5 by 6 or 8 feet. The rails were at first fastened to a chair by pins driven through them. Thus

(Sketch, page 68)

(69) but it is found that the key passing along the rail is the more secure and they are now adopting that method. The rails are 4 feet 8 inches from inside to inside. The following (see page 52) is account of the lengths and inclinations of the different sections. The moving power is principally locomotive steam engines weighing, supplied with water, from 7½ to 8 tons. Horses sometimes are still used on the road, but the great bulk of the transportation is by locomotive steam engines. The locomotives work on Sections 1 to 20, inclusive. All but one have 4 wheels, and the 6 wheels have been introduced only during the last 6 months. The regular routine of work is to take from the foot of the incline No. 21, 20 loaded waggons down to Stockton and return to the place with 20 empty waggons. The loaded waggons contain about 54 cwt. each, and the body of the waggons and axles weigh about 14 cwt.,

making 68 cwt. or 3 tons 8 cwt. each waggon, or 68 tons moving down and 14 tons moving up. The load of coals equals 54 tons. The velocity in going and coming varies from 4 to 5 miles per hour.

(70) The six wheel engine weighs without water 6 ton 15 cwt. Its regular haul is 24 loaded waggons going down and 24 empty ones back, and it performs its work with more facility & velocity than the other engines. The quantity of coal to take down 20 waggons and bring back the empty ones is about 40 cubic feet. The company contracts with individuals for the conveyance of the trains to & from. The terms of the contract are that the company furnish engine and repairs, excepting grate Bars and also finds the waggons and repairs. The engine fuel coals, attendance, oil, packing, Grate Bars for the fire are paid at the rate of ¼ of a penny per ton per mile.

This contract was commenced with the first or 4 wheel locomotive engines, but it is thought in the case of the 6 wheels to be too advantageous to the Engine and a reduction is contemplated. Coals cost the Enginemen delivered along with their engine 4/6 per ton or $1.00. The engines are worked by an Engineman and Assistant who is generally a lad of 18 or 19, who manages the fire, applies the brake, &c. The two are fully adequate to the management.

When Horse is used the usual price has been from ½d to ⅝ of a penny per ton mile. That is, the contractor finds horses and harness, the company finds waggons and repairs of waggons and pay for the haulage at the rate of ½ to ⅝ of a penny per ton per mile. Waggons can be hired at ⅛ of a penny per ton per mile.

The following is an copy of a comparative account of the expense of locomotive Eng. & Horse.

(71) Account of the Comparative Expense of Horses and Locomotives by Timothy Hackworth, on the Stockton & Darlington Rail Road, from September 1, 1826 to June 30th, 1827.

10 months Engine men at ¼d per ton mile	£ 969. 3. 8
10 months interest on Capital stock at 10 per cent per annum on 5 locomotives at £540 each=2700=	215. 3. 8
Say T. H. time divided into 4 parts or ¼ to fixed engines, ¼ to locomotives, ¼ to distribution of waggons ¼ to attending workmen at New Shildon	24. 3. 8
10 months, Grate Bars, Wheels & other repairs	186. 1.08¾
	1395. 1. 0¾

From July 1st to Aug. 1st.	
2 months as per Co'y Books Loc. Engines, Eng. Men ¼d per ton mile	231.16. 2
2 months int. on Capital at 10 per ct. per annum on 5 Engines £500 ea.	50.16. 2
T. Hackworth's time	6. 5.
2 months repairs grate Bars deducted	19
10 months total Expenses	£ 289. 0. 2

222536 tons led over 1 mile cost $\frac{1}{4}$d per ton per mile	
£289-0-2 total expenses on the above quantity.	
Same Work by Horse power.	
930416 tons led by Horses at $\frac{5}{8}$ of a penny per ton per mile	2060.10. $3\frac{3}{4}$
Allow $\frac{1}{8}$ of a farthing per ton mile upon the above quantity for keeping the Horse path in repair. 2 extra men for clearing the way (see note)	121. 2.$11\frac{1}{2}$
	£2181.13. 3

(Continuation of statement on preceding page)

(72)

Horses will be then	£2181.13. 3
Locomotive Engines	1395. 1. $0\frac{3}{4}$
In favor of the engines	796.12. $2\frac{1}{4}$

Engines did travel last winter when horses could not.

Expense of Horse Power

222536 tons led by horses at $\frac{5}{8}$d per ton per mile	492.11.$10\frac{1}{4}$
Allow $\frac{1}{8}$ of a farthing per ton per mile upon the above quantity for keeping of Horse track & extra men cleaning the way *	28.10. $6\frac{1}{2}$
	521.11. $4\frac{1}{2}$

Horse	521.11. $4\frac{1}{2}$
	289. 0. 2
	£232.11. $2\frac{1}{2}$

(* Note: This may be "extra men for greasing the wag." i.e., waggons).

The above statement was made out by Timothy Hackworth, who is the managing Engineer, a man evidently of a strong, mature judgment, close observation, and great practical skill and experience, and who appears desirous to exhibit a fair statement, and rather wishing to err against the Locomotive Engines than for them. He is, however, not a man of much theoretical knowledge and his statement is evidently not so much in favor of locomotive engines as may be deduced from his own statements.

In the first place, the locomotives were the 4 wheel one, which experience has shown cannot or rather do not perform the same labour as the 6, as the load of one is 20 waggons and the other 24.

(73) 2dly. The Locomotive Engines are not employed to the greatest advantage inasmuch as they only perform one trip per day, whereas they should perform two.

3dly. He has allowed 10% for capital stock, after bringing in all the actual expenses and contingencies; this evidently is erroneously, no more than the regular rate of interest should be allowed and an additional one to replace the engine. This item might be put at 8 per cent on this count.

4th. The item of his own services should not come into one without the other, as whether horses or Engines have been employed, his service would be required.

5th. The grate(s), which now are furnished by the Enginemen and included in their $\frac{1}{4}$d. per ton, is enumerated among the repairs and must be a very important item, as bill was £186.10.8$\frac{3}{4}$.

6. The interest on capital is assumed in the 10 mth. upon eng. costing 540, and in the 2 mth. upon eng. costing 500. As they can be obtained for 500, it should be on this basis.

7. The engines performed part of the work during the winter when horses could not work at all.

8. The price for the locomotive power at $\frac{1}{4}$ pence is too high, & all acknowledge the Horse power too low. Several contractors have been ruined by performing the work at the rate of $\frac{5}{8}$d. per ton per mile.

9. There is a numerical error in the calculation for the two months work of Horse. 222536 at $\frac{5}{8}$ is 579.10.5 and 222536 at $\frac{1}{8}$ farthing is 29.19.6$\frac{1}{4}$.

(74) To make out the comparative expense with the previous corrections we have for the price which should be paid to the engine men. 24:20::1 farthing:20/24 equals 5/6 of a farthing. The same quantity of coal will serve for the 6 wheels as for the 4, so much superior is its construction and economy of fuel.

Horse power I will take at the same rate he does, although I am convinced that it is below the mark. Then we have:

930,416 tons. Eng. men at 5/6 of a farthing per ton per mile			£ 807.13. 1
Ten month interest on 5 Eng. £500 each, £2500 at 10 per cent			208. 6. 8
Ten month repairs, as by his account 186.10.8$\frac{3}{4}$	)		185.10. 8$\frac{3}{4}$
	)		
Deduct grate bars at £1 per Loco. 5.	)		
Leaving out his superintendence		total is	£1201.10. 5$\frac{3}{4}$

2 mnths as per company's books.	
222536 tons one mile at 5/6d	198. 3. 5$\frac{1}{2}$
2 months repairs, Grate bars deducted	19.
Interest on Capital . . . . 500 x 5=2500 at 10 p.c.	50.
	£ 249. 2. 5$\frac{1}{2}$

222536 : 930416 : : 249. 2.5$\frac{1}{2}$: 1041.11.4

1860832 tons conveyed by loco. one mile is 1041.11.4)
)= 2243. 1. 9$\frac{3}{4}$
1860832 tons conveyed by horses is equal 1201.10.$\frac{3}{4}$)

at ⅝d	4845.18. 4	
1860832 at ⅛ farthing	242. 5.10	£5088. 4. 2

Or in round numbers as 5088 : 2243 or as 2.26 : 1.
That is, locomotive power is to Horse power in expense as 1 : 2.26.

(75) There are several items left out of his calculations which ought to be in, as the amount of stock waggons. If, for example, 100,000 tons are the quantity conveyed in one year, and we suppose velocity of horses to (be) 2 miles and engines 4 miles, the number of waggons for the engines will be only ½ that of the horse.

For example, if 100,000 tons be (a) year's work, take 300 working days. Then $\frac{100{,}000}{300}=\frac{1000}{3}=333$ tons per day. 3 tons to 1 waggon. $\frac{333}{3}=111$ waggons, the number of waggons necessary to have every day, and there must be the same number returned to be ready for the next day's work, 222 waggons. Of course, 111 waggons also would be required by the locomotive. Supposing the waggons to last twice as long when used by horses, as they have ½ the wear, (which they evidently will not) we still save the per centum of capital on 111 waggons. Taking the cost at £20, we save the interest on £2220 or, at 10 per cent, £222 per an., which is ½d per ton for 20 miles or 1/40d per ton per mile.

(76) The waggons employed on this road are generally made with wooden boxes, wrought iron axles and cast iron wheels with case hardened rims. Breadth of rim independent of flange from 3 to 3½ inches, with rim bevelled to from 2/8 to 3/8 of an inch in 3 or 3½ inches. Wheels are fastened to the axle; of a variety of patterns as to spokes, but the newest and most approved are similar to the Liverpool & Manchester wheels. For the other particulars of dimensions see the plans. They (the waggons) are generally connected by the centre. There have been two ways of fastening; one by a rigid iron bar connected to the end of each bar (sic. probably "waggon") and the other by means of chains. The chains are preferred by Mr. Hackworth. On the end of each . . . a hook is placed for a safety hook. They serve to connect the waggons when passing up or down an incline plane. Proper chains are kept in readiness at the planes to apply to the waggons, as the waggons are not drawn up by them, but they are put on to hold the waggon in case the centre connection should give way or get loose; the prevention chain then catches the waggon and prevents accidents.

On the Incline No. 20, 1 in 31, 37 chains long, the loaded waggons are let down from the top by a 5½ inch rope, their motion regulated by a break (brake) at the Head of the plane. They go down in trains of 8 at a time. This plane for about ½ its length is a curve about 6 to 8 inches to the chain, or chords of 132 feet.

The pulleys are placed 28 feet apart and inclined so as to make the strain at right angles to the axis of roller. It works without any difficulty. The inclined plane No. 21, 1 in 37½, 84.2 chains long
(77) is worked with the engine at the head of it.

The loaded carriages are drawn up by it in trains of 8 at a time, and the empty carriages descending carry down the rope and require the break (brake) at the head of the plane to check the motion of the waggons. The engine has 2 cylinders, each 30 inch diameter. making 21 to 22 strokes per minute, of nearly 6 feet long. The steam in the boiler from 3½ to 4 ins. above the atmosphere. A boiler to each cylinder, 11 feet long, 8 diameter, with hemispherical ends. It is considered more than adequate to do the work. It has frequently drawn up 10 wagons.

The plane is perfectly straight; friction rollers 28 to 30 feet apart. When the waggons are ascending or descending the rope sags in no perceptible degree between the pullies. When the empty waggons reach the bottom they are turned into a passing place to make room for the train of loaded ones that is to be drawn up by the rope that the empty train brought down. The tongue or switch, that is employed to give the oblique direction, is about 6 feet long by 6 in. high, with its side protected by plates of iron. The plate will show how it is situated.

The train is fastened by means of a catch that is described in Plate No. . The signal when the waggons are ready is by turning a target (about 4 feet in diameter, painted white with a circular ring centre of 18 inch diam. painted blue) from standing edgewise to broadside to the engine house. The same rope works from the top of this plane both ways. Working from the top of the drum in hauling up one side,
(78) and from the bottom on the other. No advantage is taken of the preponderance down one side to assist the ascent up the other. The situation of the drum with respect to the road will be best seen by the Plan No. The number of men to manage these two planes are 3. An Engineman who watches the target and puts in motion and stops the Engine. A man accompanies the ascending train and fastens and disengages the ropes, and a Fire tender who tends the boiler. The planes 24 & 25 are worked in the same manner. The remainder of the line and the various branches to the collieries are worked by Horses. The usual load for a horse is 4 loaded waggons down and returning with 4 empty ones. A trip in two days. It is considered the outside of a horse's performance and requires the most powerful animals.

Mr. Hackworth thinks 6 tons of coal a sufficient load. 1 man manages the 4 waggons and 1 horse.

Mr. Hackworth mentioned that his confidence in the economy of locomotives had increased the more he became acquainted with them. He mentioned an instance where the 6 wheels (Locomotive) took 28 empty waggons up an ascent of ½ in. to the yard or 1 in 72, for a distance of a mile, at the rate of 4 to 5 miles the hour. His wheels being 30 inch and axles 3 the dimunition is 1/10. Wood makes the friction at the

axle 1/17, thus 1/170 equals the friction on 2 ft. 6 (") wheels 28x14x112 =43904+2240 wt. of tender=46144. 28 waggons weighing each 22 to 23 cwt.=30 ton 16 cwt. 30 ton 16 cwt.—1.4 ton tender=32 tons load carried up,=71680, say 72000 lbs.

$$\frac{72000}{72}=1000 \text{ lb. gravity} \qquad 1271 \text{ lb. equals wt. raised}$$

$$\frac{46144}{170}=271 \qquad \frac{8 \text{ tons wt. Eng. \& water}}{1271}=14$$

(79) The eng. moved 1/14 of its weight.
In another instance it raised up an elevation of 1 in 144

26 empty waggons=26x22 cwt.=	28 tons 12 cwt.
13 loaded waggons=13x76 cwt.=	49 tons 8 cwt.
	78 tons=2240x78

$$\frac{2240x78}{144}=1213.33 \text{ gravity}$$

Friction of 26 empty $=\frac{26x12x112}{170}=\frac{40768}{170}$

$$=\frac{139768}{170} \qquad 822$$

Friction of 13 loaded $=\frac{17x68x112}{170}=\frac{99008}{170}$

Thus 1213.33—822=2045.33 raised up)
) 2073.83
Gravity and friction of tender 28.50)

Thus $\frac{17360}{2073}$=8.3 or the engine moved $\frac{1}{8.3}$ of its weight.

Mr. Hackworth gave it as his decided conviction that the 6 wheel Eng. would take to Stockton, a distance of 20¾ miles, 32 loaded waggons and return with 32 empty ones and perform the distance in from 3½ to 4 hours, total time going & coming. The locomotives on this road have substituted a connecting bar instead of the chain and it is found to answer better. The floating pistons have been done away with entirely and springs substituted. The 6 wheels (engines) weigh 6 tons 15 cwt without water or fire in her. Water may weigh about 1 ton. Expense of keeping a horse on this road is as follows, according to Mr. Hackworth.

1 bushel corn per day. 7 per week at 2/6 17.6
14 lbs. hay per day. 7x14 per week at 14 1b/6d 3.6

1.1

21/6=3/5 per day.

His engine men thought that a horse would require 12 stones per week. Therefore 12 stones at 6. equals 6. 17.6 plus 6. equals 23.6 23.6=3s 11d or 4/ per day, taking the price of corn at 2/6 and hay 6d per 14 lbs.

Corn varies from 2/8 to 3/6. Hay varies from 6 to 9d.

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(80) On this road the friction of waggons is (taking Wood as a standard) 1/170 of the load. The West Brunetton plane is 84.2 chains long and the load up it is a train of eight loaded carriages,

8x22=wt. of carriages= 176 cwt.)
) gives for gravity
8x54=wt. of load =(432 cwt.) 608+33.5= 2032.68 lbs.
(
8x14=wt. of body & axles (112 cwt.

544 cwt.+170=Friction 358.40

84 chains of rope=5544 feet at 1.75 lbs. per ft.
gives 9702+33½ = 289.40
No. of shieves in action 150 at 30 lbs. each is
4500 lbs. weight of shieves
9702 lbs. weight of rope
289 lbs. pressure of pulleys

14491+3=4830, which divided by 14 330.00

Equals 3010 lb. raised perpendicularly 3010.48
Diameter of cylinder 30^2=900x.7854=706.5 Area of 1 C
706.8x2=1413.6 sq. (") surface of piston.

(81) The arrangement for unloading coal is very simple. When the coal is to be deposited in a depot, the plan No. will show the plan, and when a vessel is to be loaded they adopt the plan in Plan No. . The turnout in plan No. is used to change the direction when it makes an angle too great for the single branch. The oiling is done by the assistant to the Engine man. He is provided with a stick having a swab on the end, and applies the oil by means of it to the underside of the axle beneath the Bearing. It is performed with a good deal of facility & is done before the waggons set off, once on the way, again at Stockton, and a fourth time on the way back. Attempts have been made to apply the oil by means of a hole going down through the bearing; but it is found to fill up and to give considerable trouble to keep it in a state to feed the bearing as it ought. The method I have

described is that universally adopted on the Stockton and Darlington Road. The Engines are supplied with water by means of pumps which are erected along the road. There is about one pump to every 5 miles.

Wheels and Axles

(82) On this subject I have collected all the information that the country affords. I have examined the wheels and their mode of operation on the roads which are considered the models of others, and have had much discussion on the subject with the principle practical men in this country.

I find on the most important rail roads that fixed wheels and revolving axles are used invariably. On the Hetton, on the Stockton and Darlington, on the Killingworth, on Mr. B. Thompson ('s) and they are to be used on the L. & Manchester. From conversation I learn that from time to time persons have attempted to introduce loose wheels, the additional friction arising from both wheels being fast to one axle was too evident to be overlooked and many contrivances have been adopted and necessarily laid aside. Formerly, when the operation of case-hardening was less perfect than it is now, the friction in turning a curve rendered itself much more evident than it does now, by grinding into the wheel and an abrasion of the surface. Once commenced it wore into the wheel rapidly. At present the case-hardened wheels are proof almost to the file and they have the friction without the attending destruction of the wheels. Its disadvantages are therefore much less apparent. In all the attempts previously made to do away with the difficulties of turning a curve, it has always been with fixed axles and loose (wheels), so that all the wear was in the nave of the wheel. This was found to be very considerable. The underside of the axle
(83) wore flat or coned into this shape (see sketch) and the points A & B soon ground away the nave, the wheels became loose on the axle and a wobbling, uneven motion was the result. The disadvantages rising from this cause have always been considered on trial to be greater than those of the friction at the surface of the rail with fixed wheels. The result has been, they have made the roads so near straight as to diminish the unequal motion of the wheels and made the friction consequently quite small. There is another circumstance which, though the engineers have not taken into account, has tended very much to diminish the friction. The rims of the wheels are bevelled from 2/8 to 3/8 of an inch. Then the axles have 1 inch play, that is, the distance between the inside of the flanges is one inch less than the distance between the rails. In turning a curve, the tangential tendency of the wheels crowds the outside wheel close to the rail and, of course, the inside one is drawn from it; consequently the outside wheel will run on a diameter of 2/8 of an inch greater than the inside one, for the wheel bevelling 3/8 in 3 inches will bevel 1/8 in one inch. Now the wheels being 30 inches in diameter, the outside wheels will revolve on a diameter of 30 inches plus 2/8, equals 242/8, and the inside one (revolves) on a diameter of 30 in.—2/8, equals 258/8 (sic.) Then 262-258/8 equals

4/8 equals 1/2 an inch difference of diameter; then to find the circle in which two wheels (revolve) one 258/8, the other 262/8, and distant apart 56 inches, we have to get the radius.

(Sketch, page 83)

AB :BC : :AD :DC or

$$\tfrac{1}{4} : 56 : \frac{262}{4} : \frac{252\text{x}56}{4} + \tfrac{1}{4} = 262\text{x}56 = 14672 \text{ inches, equals } 1222 \text{ feet.}$$

Diameter then equals 2444 feet.

(In Mr. Allen's computations several obvious errors appear, some of which he has corrected in one place but not in others. His figures are shown as they appear in the diary, except for one minor and hardly decipherable equation. Editor.)

(84) This would give a curvature of about 18 in a chain. That is a versed sine to 132 feet chord. Very few of the curves on the road amount to this, in fact most of them are not ½ of this. When, therefore, the small degree of curvature on the English roads, the partial correction of the curvature by the bevelling of the wheels, the perfect case-hardened surface of the wheels, are taken into consideration, the fixed wheels and revolving axles are probably preferable in their situation to the loose. At the same time, I am convinced that the wheels & axles may be so connected as to combine all the advantages of the two methods and be free from the disadvantages, and that even on their roads would be superior to the present. The plan is to have the axles revolve and the carriage to be supported by the chairs resting on the axle evenly as when the wheels are fastened to the axle. But also to have one wheel loose on the axle. I have seen some wheels upon this principle and the operation is this: when the road is straight the wheels and axles all revolve together, the rubbing surface is in the bearings and the effect is precisely the same as in the case of wheels fast to the axle.

When, however, the curve is entered or the wheels are so situated that one wheel tends to revolve faster than the other, then the loose wheel gives way, and a positive revolution round the axle takes place, just enough to make up the difference of the motion of each wheel,
(85) and when waggon gets into the straight part of the road, the wheels and axles move together again as if they were fast together. The above plan appears therefore to unite the points of each of the two plans.

1st. It brings the friction at the axle principally on the axle and bearings. As the axle wears away, therefore, it still continues truly circular. 2nd. It yields sufficient on curves to prevent any dragging of one wheel to accommodate itself to the motion of the other. I could not learn that this arrangement, simple as it is, had ever been tried on any of the principal roads to whose experience we should look for the best arrangement. They seem to have thought that we must have fixed wheels or loose wheels, and never to have considered and put to

test the experiment of the medium plan of having both fixed and loose wheels. Their not having them in use is therefore not to be considered as a decision from experience against them. The only person whom I have met with who has had any experience in the adoption of this arrangement is Mr. Sparrow, of Wolverhampton. His road is considerably curved and at first fixed wheels were employed, but he found the additional power to move them round curves so considerable that he made the axles fast and used loose wheels. This remedied the defect that he aimed at relieving, but it introducd another, viz., wearing in the axles and the consequent wobbling motion. He then tried loose axles and one loose wheel. This he found did better, but he met
(86) with another arrangement of which the principal is the same, and which he finds decidedly the best plan he has yet attempted.

Mr. Rastrick, of Stourbridge, is making a railroad about 5½ miles long and intends employing wheels of the description on plan No. 2. I am therefore fully of the opinion that the best construction for your road is to have bearings on the bottom timbers and the axles exactly as if the wheels were fast to the axle and have the wheels moveable round the axle.

As to the size of wheels I find that they have been for the last 15 years gradually increasing in size: on the Stockton and D they are 2 feet 6, and the superintendent on the other roads here use from 2 ft. 6 to 34 or 36 inches. 3 feet wheels are the largest yet used, but I have, in all the discussions that I have had with the engineers, met with no reason derived from experience or any principles that which decides upon the present size being the limit. They none of them seem to have any accurate method of determining what should be the size of wheels, but the only reply they make is, "To be sure, we save a little friction from the increased diameter, but if the rail be perfectly smooth, the advantage is not much, and by making the wheel larger we add to the weight." It is a singular circumstance that they have reduced it to some accuracy. Perhaps it will not be thought improper if I give a rule which my own reflection and observation has suggested.
(87) 1. If we add to the diameter of the wheels we must add to weight of wheels; this should be made in comparison to the advantages derived from the diminished friction at the axle. But upon an ascending plane the additional weight operates immediately against the advantage. Thus if we have wheels of 2 feet 6 inches and weight w, and increase the diameter to 3½, then the weight will be W, but if the friction in the 2 feet 6 in be (sentence unfinished).

I send you 3 different plans for the wheels and axles.

1st is from Mr. R. Stephenson of Newcastle. They usually make them with the wheels fixed to the axles, but upon my request he fitted up one with the wheel loose. 2nd is from Mr. Foster & Rastrick of Stourbridge. 3rd is upon the principle of Mr. Sparrow's wheels.

From these you will be enabled to select the one that will meet your purposes best. I like the plan of No. 3 much. It would first strike one that the wearing would be at A & B, and to determine the wearing let us take a road, one curving 1 foot to the chain for the whole Run. The

revolution of the axle in the hub, or the wheel around the axle will be to the revolutions of the axle in the bearing as 1 : 1090. Which shows how very little will be the wear in the hub or wheel to the other wears of the carriage. The prominent difficulty of the loose wheels has been found to be that they will not keep the road. The reason for
(88) this I did not learn. That is, when I asked why this would take place, I was answered that they only knew the fact and that, if loose wheels would not keep the road, it was of but little consequence what was the cause, as they must be removed. I think, however, the cause to be this: the flange of the wheel is one inch deep and bevelled from the wheel. The wheel wears away at the nave and thus becomes capable of being inclined to the axle. When, therefore, the wheel inclines outward the wheel rises on its point A, and the flange is raised above the level of the surface of the rail and therefore offers little or no resistance to the passage of the wheel on the road. The plan of axle upon bearings does away with this wearing in the nave, the wheel can never be inclined to the plane of the road and therefore be just as likely to keep it as with the fixed wheels. Another circumstance is that the bevelling of the wheels of $\frac{3}{8}$ of an inch of itself tends to bring the wheel into the inclined position and diminish the resistance derived from the flange to the wheels climbing the rail.

We . . . easily calculate the quantity of wear necessary to permit the wheel to go of with much greater ease.

The Steam Locomotives of the Pennsylvania Railroad System

By Charles E. Fisher

April 13th, 1846 marked the date of incorporation of a railroad, that in the years that followed, grew to be fourth in size from a mileage standpoint but ranks first in operating revenues. Over 600 separate railroad corporations have been welded into this vast system. This growth was achieved through the efforts of J. Edgar Thomson, Chief Engineer and subsequently President of the railroad, who wisely acquired controlling interests in certain railroads west of Pittsburgh and thus laid the foundation for the present system. This was accomplished on sound, conservative lines and the fact that the company has never been in the hands of the courts is testimony to the sound judgment of the management.

The development of the motive power of this road has proceeded along these same lines. No new types or designs have been introduced on a large scale until an investigation and trial have demonstrated their fitness. This, once proven, expenditures have been liberal. This has been accomplished through the Department of Tests at Altoona, which with its equipment and research facilities has no equal among the railroads of this country. The road has adhered strictly to the policy of training its own men and making promotions from within its ranks. At the close of the Civil War, the road prepared to standardize the designs of its locomotives and since that date the road has followed this policy. Experimental locomotives have been built in its own shops, in the plants of the various builders and even imported from abroad in order that their results may be studied and compared with those already in service and, it might be well to add here, that a locomotive constructed in the shops of a builder to the specifications prepared by the road, is exactly the same as one of the same class built in the company's shops at Altoona.

But before we consider the locomotives of the Pennsylvania, suppose we take a look at those on two railroads that were subsequently absorbed by that railroad.

The New Jersey Railroads

As early as 1812, John Stevens had applied to the State Legislature for permission to build a railroad within the border of the State of New Jersey, but nothing ever came from it. It was not until December, 1832 that the Camden & Amboy R. R. completed the 26½ miles between South Amboy and Bordentown and to Camden, opposite Philadelphia, in September, 1834. The road operated a line of steamboats between South Amboy and New York and its relations with the New Jersey R. R. & Transportation Co., have already been covered in our Bulletin 88. These roads were a vital link in our transportation system in the east.

Late in 1830, Robert L. Stevens, president of the railroad, was authorized to go to England and arrange for the purchase of iron rails and a locomotive. It was on this voyage that he amused himself by carving out of wood various cross sections of rails until he hit upon the present "T" rail with its broad base for the head and web. He also designed the first claw spike and the fish-plate to hold the rails together.

He visited the works of Robert Stephenson and was present at the trial of the locomotive "Planet." An order was placed for a similar locomotive but with these differences: a boiler with a circular firebox and domed top (Bury) was specified much to the disgust of the builder; the original "Planet" had 11x16″ cylinders while the locomotive ordered by Stevens had 9x20″. Coupling rods were intended to connect the wheels; whether the application of the hideous cowcatcher subsequent to the delivery of the locomotive, prevented their application or they were discarded because it was felt they were of little value, it is difficult to say but, the locomotive as subsequently used could properly be classified as a 2-2-2-0.

Originally named "Stevens" but subsequently dubbed "John Bull," the locomotive arrived in Philadelphia in August of 1831 and was transferred to a sloop that brought it to Bordentown. Here, under the supervision of Isaac Dripps, still an apprentice machinist and working on the erection of marine engines, the "John Bull" was assembled. The engine weighed 11 tons; boiler was 13 feet long, 3 feet 6 inches in diameter and the four driving wheels were 4 ft 6 inchs in diameter. No tender was provided and a small car that would carry enough wood for a short trip and a whiskey cask with a leather hose connected to the engine feed pipe was made to serve the purpose. The sharp curves of the road were doubtless the reason for the omission of the side rods but the addition of the cowcatcher, like the tender, was a "home application."

Whether additional engines were purchased in England or the "John Bull" served as a model for locomotives built in their shops at Hoboken, we do not know. The U. S. List of 1838 as well as von Gerstner indicated that eight more locomotives similar to the "John Bull" were in service and rosters of locomotives that appeared in subsequent reports indicate a change in the dimensions of the cylinders on some of these engines. The 1850 roster shows the "John Bull" with 11½x20″ cylinders and the P. R. R. roster of 1884 repeats these dimensions. Altho' credited to one E. K. Dod, who may or may not have been in charge of these Hoboken Shops at the time, it was not long before Isaac Dripps cared for their "flock" of locomotives and later served the P. R. R.

Two rather curious types of locomotives used by this road deserve mention. The first, known as the "Monster" was first built by Dripps in the company shops about 1836. Of the 0-8-0 wheel arrangement, 18x30 inch cylinders, boiler built to burn anthracite, the crown sheets for the fire box and combustion chamber were supported by crow-foot stays, which gave satisfaction. Each set of wheels was free to move

in a plane slightly different than the other set which allowed some flexibility. The cylinders were set on an angle of about thirty degrees with the piston working towards the front; the cross head connected with a vibrating beam that moved like a pendulum and the main rod was connected with this pendulum to the third pair of drivers. The first and second pairs of wheels were independently connected by rods and the second axle was geared through an intermediate spur wheel to the third axle. No frame was used and all attachments were secured to the boiler. Possibly five of these locomotives were built and one at least, was rebuilt to a 4-6-0 type in 1869 and continued in service until 1875.

The second type were the "Crampton" locomotive built by Norris Brothers for fast passenger service between 1848 and 1851. They resulted when President Stevens visited Europe in 1845. These locomotives had a single pair of drivers supported by a six-wheel truck under the forward end. The boiler was set very low and the firebox had a sloping roof sheet that extended under the driving axle. The boiler was only 38 inches in diameter. The fire door was below and behind the axle and the fireman stood in a pit, the bottom of which was about on a level with the ash pan. These locomotives had a cylinder diameter of either 13 or 14 inches and a stroke of either 34 or 38 inches. Two locomotives had drivers seven feet in diameter and five had eight foot drivers. The weight was between 46,000 and 47,000 pounds. Although these locomotives could run at very high speed, faster probably than track conditions would warrant, they were slippery and deficient in starting power and the majority of them were rebuilt to 4-4-0's with 72" drivers.

The inventory of the locomotives of this road for 1867 presents a motley assortment of power, many of which were built or rebuilt in the company shops in Hoboken or Bordentown with many new engines from the Danforth & Cooke Works. The name of Robert L. Stevens and his "T" rail and Isaac Dripps will always be associated with this railroad. The "Monsters" and "Cramptons" served their purpose but their first locomotive, the "John Bull," proudly drew her train of two coaches all the way to Chicago in 1893 and is now preserved in the Smithsonian Institution in Washington. The engine has been loaned for exhibition purposes many times since.

Of the locomotives on the Philadelphia & Trenton R. R., the "Black Hawk," completed by M. W. Baldwin in May, 1835, construction No. 11, deserves passing mention. Of the 4-2-0 type, it was the first Baldwin locomotive to have outside cylinders and it also used a device patented by E. L. Miller that permitted part of the weight of the tender to be shifted to the locomotive, to increase the adhesion in starting, a device frequently used by Mr. Baldwin on his single driver locomotives.

To the New Jersey R. R. & Transportation Co. was delivered the first true Mogul (2-6-0) type locomotive. Completed Oct. 29, 1863, road No. 35, construction No. 1106, she was followed a week later by the No. 36, both had 17x22" cylinders, 54" drivers. It is true that

locomotives of this wheel arrangement had been built prior to these two locomotives but these were the first six-coupled locomotives to have a two-wheeled, swing bolster leading truck equalized with the first pair of drivers. The road also used a Stephenson link motion placed outside the drivers. The majority of their locomotives came from Danforth & Cooke or Rogers with quite a few built in their own shops at Jersey City, N. J. As stated in Bulletin 88, this road was consolidated with others to form the United New Jersey R. R. & Canal Co., and, on June 30, 1871, the property was leased to the Pennsylvania R. R. thus giving that road an entry to the shores opposite New York City.

The Philadelphia & Columbia Railroad

With New York City gaining commercial strength from the Erie Canal and with Baltimore and Charleston (S. C.) engaged in building railroads into the interior, the citizens of Philadelphia soon realized that they too must have some means of transportation to the mid-west. Accordingly, there was built what became known as the Main Line of the Public Works of the Commonwealth of Pennsylvania. This constituted a series of railroads and canals, the construction of which was authorized in 1828. It consisted of an 82 mile railroad between Philadelphia and Columbia which went under that name; the Eastern Division of the Canal from Columbia to Hollidaysburg, 172 miles; the Allegheny Portage R. R., a thirty-six mile railroad crossing the Allegheny Mountains between Hollidaysburg and Johnstown and the Western Division of the canal, 104 miles from Johnstown to Pittsburgh. The entire line was opened in 1834 and probably, the construction of the canal boats, in sections, so that they could be taken apart with their lading and mounted on the cars of the Allegheny Portage R. R. and assembled upon the completion of the trip, was ingenious for that or any period. Altho' the system was a great benefit to the citizens of the commonwealth, it was not remunerative.

At either end of the Philadelphia & Columbia R. R. was an inclined plane, worked by stationary engines, to haul the cars up the banks of the Schuylkill and Susquehanna Rivers respectively. The road had plenty of short, sharp curves and grades. It was first used as a public highway upon which any individual owning a horse and the proper vehicle could engage in business. Add to your troubles that the road was but single track and that steam locomotives were used and, you have a first class "mess." Until the time the road was double tracked, passing tracks were built every few miles and half way between these passing tracks was erected the "Half way post." The driver of the vehicle that was past the half way post could back the driver coming from the opposite direction to the next siding. This resulted in furious driving to the half way posts and a leisurely gait was continued to the passing track. Finally, on April 1, 1844, the use of horses and privately owned vehicles was prohibited and this put an end to the confusion.

The Canal Commission recognized the advantage of the steam locomotive at a very early date. In 1838, there was published in the

report of this railroad, a list of all of the locomotives that had been in use up to this time. It lists 24 from M. W. Baldwin; 5 imported from Robert Stephenson and two of these five as having been sold; 11 from the Norris Works, 9 having been transferred to the Portage Road; 2 from Coleman, Sellars & Sons; 3 from Young, Newcastle, Delaware; 3 from Garrett & Eastwick and 2 from McClurg, Wade & Co., both sent to the Portage Road. But of all of the builders, those of M. W. Baldwin were the favorite and the statement to that effect is made in the Knight and Latrobe report of 1838.

The third and fourth engines built by M. W. Baldwin were the "Lancaster" and "Columbia" delivered to this road on June 25th and July 2nd, 1834, respectively. Both were of the 4-2-0 type with 9x16" cylinders and 54" drivers, weighing about 17,000 pounds in working order. These were followed by about thirty more locomotives from this builder during the existence of this railroad.

Contemporary with the early Baldwin engines were those from William Norris of Philadelphia. The chief difference between the locomotives of these two builders was the fact that Baldwin placed his drivers behind the firebox while Norris placed his ahead of the firebox. This made the Baldwin engines, with their longer wheel base, a very steady riding engine and they were preferred for passenger service. The Norris engines, with more weight on the drivers, had greater hauling capacity and were used in freight service.

The Norris engines jumped into fame when the "George Washington," on July 10th, 1836, hauled a load of 19,200 pounds up the inclined plane at Philadelphia. The locomotive is stated to have had $10\frac{1}{4}$x$17\frac{5}{8}$" cylinders, 48" drivers and weighed 14,930 pounds, with 8,700 pounds on the drivers. With 60 pounds steam pressure, it attained a speed of 15 miles an hour with this train on the incline. A similar locomotive, the "Washington County Farmer," on one occasion hauled a train of 28 cars weighing $141\frac{3}{4}$ tons over the road. This was the first outside connected engine built by Norris. This performance was exceeded by Baldwin's "West Chester" that hauled a train of 51 four-wheel cars weighing 289 net tons over the road. For further details of these Norris locomotives, our members are referred to our Bulletin 79, authored by Mr. Dewhurst.

In April of 1845, Mr. Baldwin delivered the "Atlas," 13x18" cylinders, 42" drivers and weighing 33,600 pounds. This was of the 0-6-0 type with the well known flexible beam truck, a device that permitted the first and second axles a certain amount of lateral motion which was facilitated by the coupling rods having spherical brasses and the driving boxes were fitted into cylindrically bored pedestals, held by vibrating beams. This permitted a certain flexibility which was badly needed by the uneven track and sharp curves. Two more engines, the "Lewiston" and "Chester" followed in March, 1847, similar to the "Atlas" but with $13\frac{1}{2}$x18" cylinders. Two 4-4-0 type locomotives were purchased from Baldwin in 1854 and these were the last two furnished the Philadelphia & Columbia R. R., the road purchasing a number of locomotives from the works in Lancaster, Pa.

The Pennsylvania R. R.

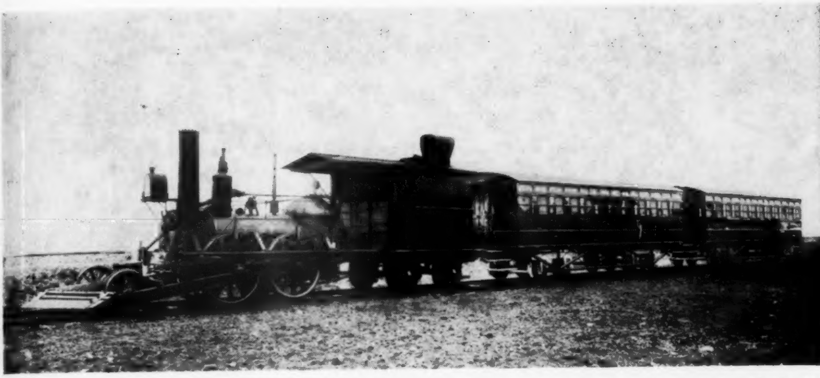
Although the system of railroads and canals owned by the Commonwealth of Pennsylvania was a monumental piece of construction, it was totally inadequate for the needs as traffic increased. What was really needed was a railroad from Philadelphia, extending across the state and thus the city could compete on equal terms with New York City and Baltimore.

On April 13th, 1845, the State Legislature passed an act incorporating the Pennsylvania Railroad and the bill was signed by Governor Shunk. This bill authorized that railroad to construct a line between Harrisburg and Pittsburgh, there already being the Harrisburg, Portsmouth, Mt. Joy & Lancaster R. R. connecting Harrisburg with the Philadelphia & Columbia R. R.

It was under the supervision of John Edgar Thomson, builder of the Georgia R. R. & Banking Co., that the road made such rapid progress. Contracts were let for grading at both ends in July of 1847. On September 1, 1849, 61 miles between Harrisburg and Lewistown were opened and, on December 10, 1852, cars were run through from Philadelphia to Pittsburgh using the Portage R. R. over the mountains. On February 15, 1854, their own line over the mountains was completed and the use of the planes on the Portage R. R. was discontinued. On August 1, 1857, the system of State Railroads and Canals was purchased by the Pennsylvania R. R. and on December 29, 1860, the H. P. Mt. J. & L. R. R. was leased for 999 years, thus giving the Pennsylvania its own line between Philadelphia and Pittsburgh.

The Annual Report for 1850 lists the locomotives owned by the road; 23 built by Baldwin and three built by Norris. The locomotives are listed in alphabetical sequence and most of them named for the counties of the Commonwealth. The report for 1854 is the first one showing the locomotives assigned to the Eastern and Western Divisions and the report for 1857 shows the locomotives acquired from the Philadelphia & Columbia R. R., then and now known as the Philadelphia Division. Numbers had been assigned to locomotives at the time of this report and this is the last one to show the names carried by the locomotives. The report for 1862 is the last one that lists the locomotives in complete detail tho' certain motive power data is given in the ensuing reports for several years. It is upon these reports, the records of the various locomotive builders, that the 1847-1869 roster concluding this article is based and, this will be the only roster published in connection with the articles.

For the first twenty years, the motive power of the Pennsylvania R. R. differed but little from that of any other road of the period. Each locomotive builder built according to his own ideas and standards with no regard to his competitor. There might be quite a variation in his product within a year. Thus, the motive power of our early roads furnished a wide variety of locomotives and types and it was only the few making up a single order was there any likelihood of their parts being interchangeable. There is little doubt that the Baldwin engines



The famous "John Bull" of the Camden & Amboy R. R., and train, shown here as rebuilt and enroute to the World's Fair, Chicago, 1893.

One of the Cramptons on the Camden & Amboy R. R. built by Norris Bros.

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We

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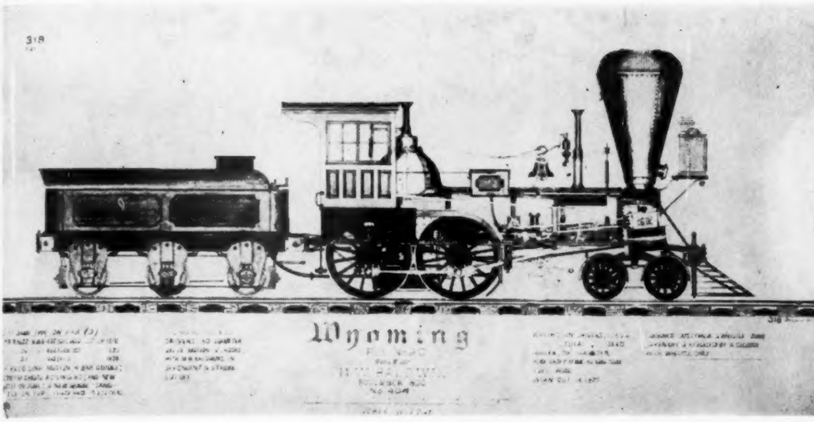
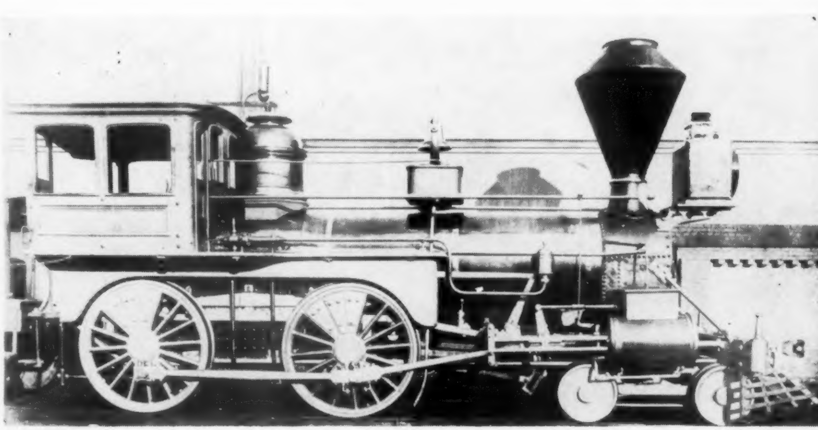
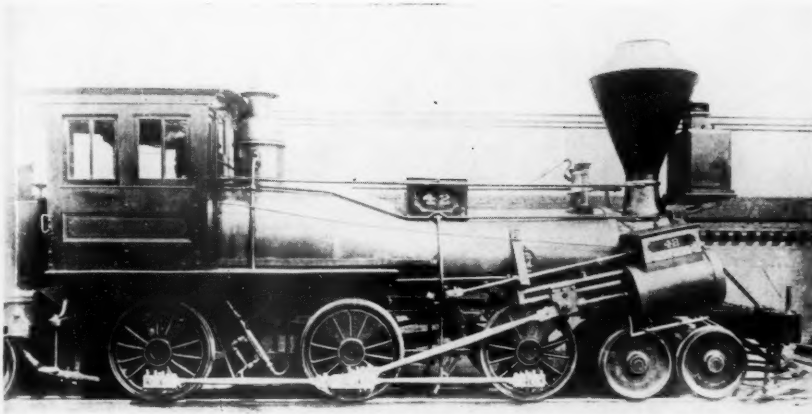
Dr



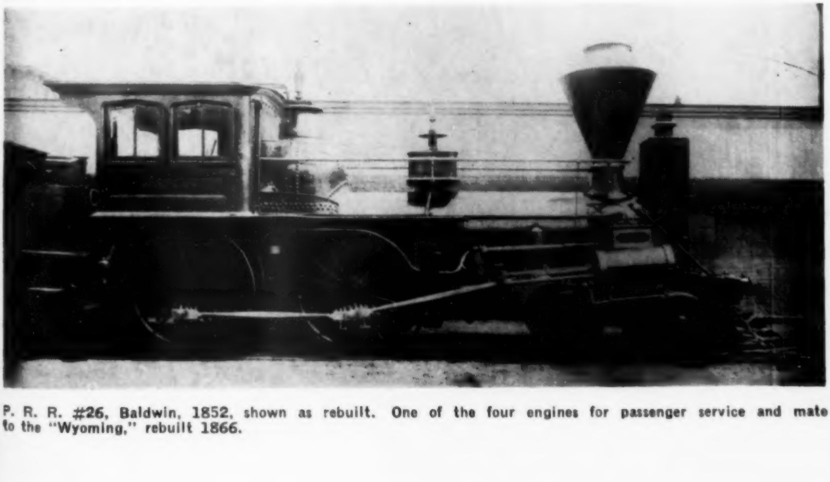
P. R. R. "Wyoming," Baldwin 1850—one of four engines for passenger service. Cyl. 13½x22", Drivers 60", Wt. of locomotive 38675 lbs.



P. R. R. #40, Wilmarth, 1852, shown as rebuilt, one of three engines for passenger service. Cyl. 16x22", Drivers 66", Wt. of locomotive 59000 lbs.



P. R. R. #42, Baldwin 1852. Originally 2-6-0 type, shown as rebuilt. One of six locomotives for freight service. Cyl. 18x22", Drivers 44", Wt. of locomotive 59600 lbs.



P. R. R. #26, Baldwin, 1852, shown as rebuilt. One of the four engines for passenger service and mate to the "Wyoming," rebuilt 1866.

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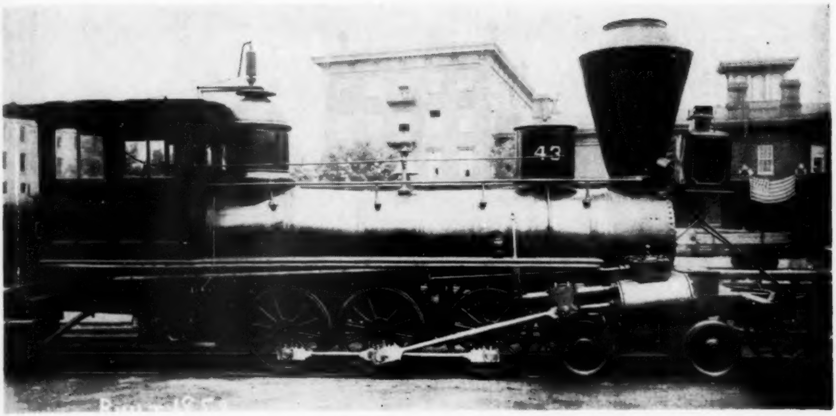
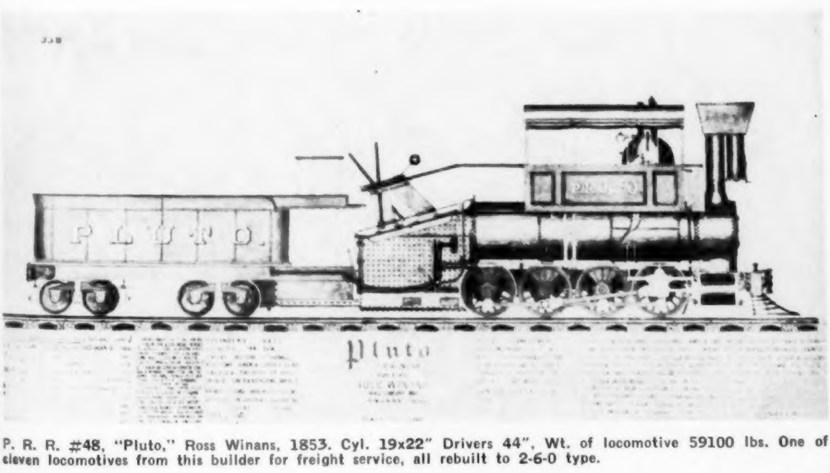
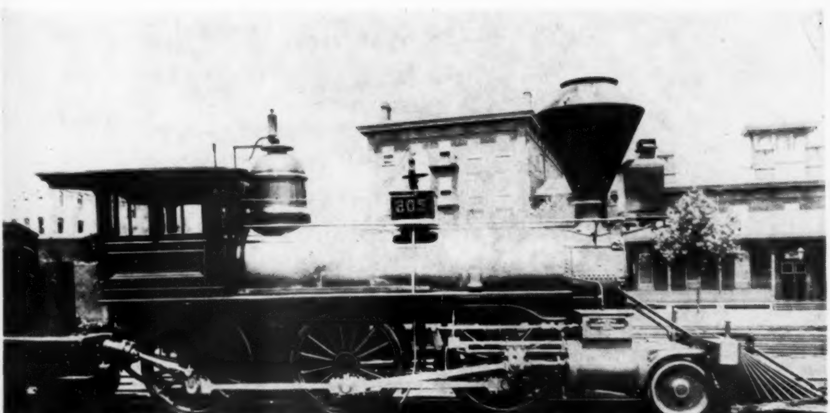


P. R. R. #43, Smith & Perkins 1852, Cyl. 17x22", Drivers 44", Wt. of locomotive 54200 lbs. One of a dozen engines from this builder for freight service, shown as rebuilt.

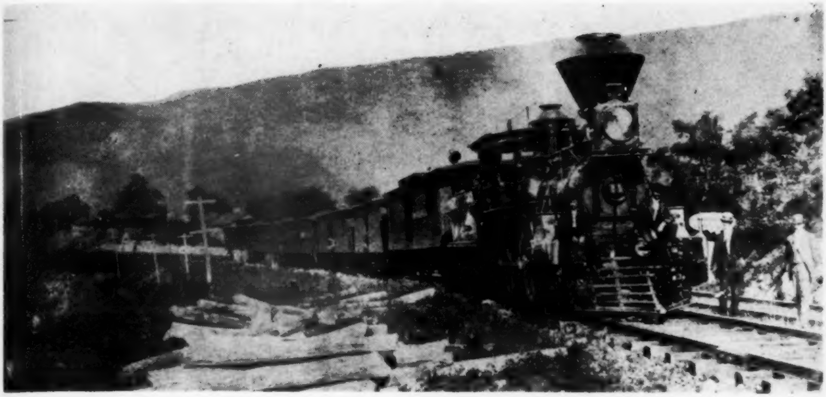


P. R. R. #48, "Pluto," Ross Winans, 1853. Cyl. 19x22" Drivers 44", Wt. of locomotive 59100 lbs. One of eleven locomotives from this builder for freight service, all rebuilt to 2-6-0 type.

P. R. R. #48, Ross Winans, 1853. Shown as rebuilt in 1864.

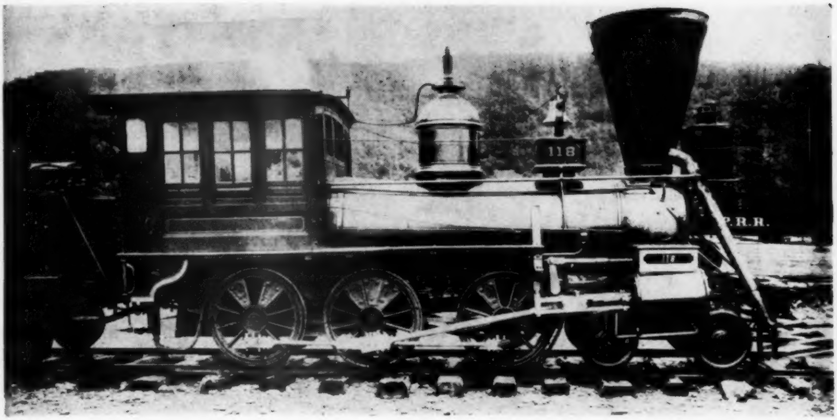


P. R. R. #205, Norris, 1854. Cyl. 17x24", Drivers 48", Wt. of locomotive 64800 lbs. Shown here as rebuilt in 1866.

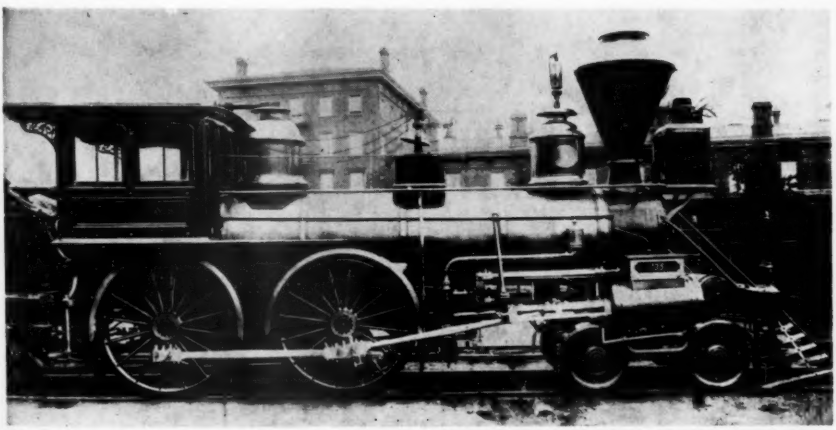


P. R. R. #85 on the west bound "Fast Mail" near McVeytown, Pa., in 1869. Locomotive built by Norris in 1854, rebuilt in 1865.

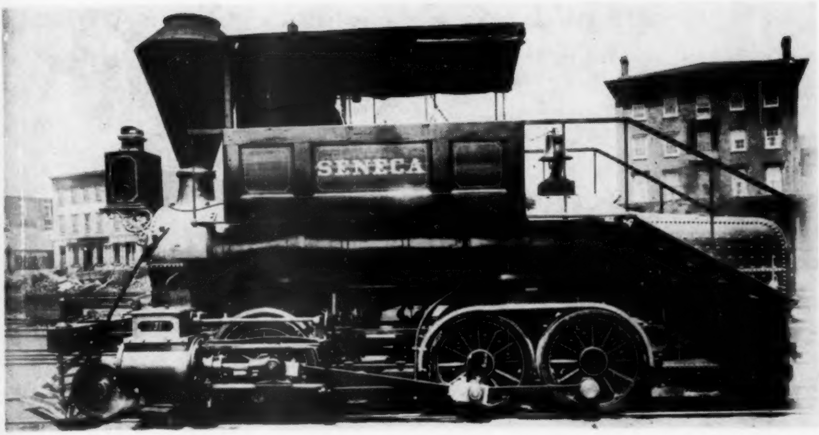
P. R. R. #117 on freight train during Civil War. Locomotive built by Baldwin, 1855. Shown here as rebuilt.



P. R. R. #118, Baldwin, 1855. Cyl. 19x22", Drivers 48", Wt. of locomotive 61000 lbs. Built for freight service, shown as rebuilt.



P. R. R. #135, Baldwin 1856. Cyl. 15x24", Drivers 66", Wt. of locomotive 59100 lbs. Built for passenger service.



P. R. R. #131, "Seneca," Ross Winans, 1856. Cyl. 19x22", Drivers 44", Wt. of locomotive 59150 lbs. Originally 0-8-0 type, shown as rebuilt in 1862.

P. R. R. #195, Lancaster L. W. 1857. Cyl. 16¼x22", Drivers 66", Wt. of locomotive 60000 lbs. Originally the "Breckenridge" on the Philadelphia & Columbia R. R.

remained the favorites until the time came when the road built their own engines at Altoona. Norris of Philadelphia, Ross Winans of Baltimore and Smith & Perkins of Alexandria, Virginia all added their quotas, with a few from other builders.

The first two locomotives built by Baldwin for this road were the "Dauphin" and "Perry," construction Nos. 333 and 334, completed November, 1848, prior to the completion of the road. The former was placed in service in 1849, the latter in 1850. Both were the 0-8-0 type with Baldwin flexible beam trucks and had the hook motion for the main valves with independent cut off. Both locomotives were subsequently sold to the Philadelphia & Reading R. R., but the "Westmoreland," similar to the pair and completed in April, 1850, remained in service for many years.

It would seem as tho' the first engine built by Baldwin that was actually placed in service was the "Mifflin," completed July, 1849, construction No. 356. She was intended for fast passenger service and was followed by the "Blair" and "Indiana." All had a single pair of drivers back of the firebox with a pair of carrying wheels in front of the firebox and a four-wheel truck under the front end, similar to the famous "Governor Paine" of the Vermont Central which has been so frequently illustrated. A traction increaser was provided that added weight to the drivers in starting. These locomotives proved to be very fast with light trains and the "Mifflin" and "Blair" were rebuilt to the 4-4-0 type. Between the years 1850-1852, these locomotives were followed by a group of 4-4-0 locomotives, the majority of which had 15x20″ cylinders, 54″ drivers and of various weights.

Late in 1852, Baldwin completed a group of six coupled locomotives with 18x22″ cylinders and 44″ drivers. Some of these locomotives had four-wheeled leading trucks and others had only two, placed under the cylinders. The former weighed 64,500 pounds with 46,000 pounds on the drivers. The latter weighed 60,000 pounds with 48,000 pounds on the drivers. The weight on the leading truck was considered excessive and all were subsequently rebuilt and a four-wheel truck was substituted for the single pair originally applied. The Baldwin records do not state the different types and all have been listed as 4-6-0's in the roster.

In addition to these 2-6-0 type locomotives from Baldwin were a group of locomotives from Smith & Perkins and two from Norris. These had 17x22″ cylinders and 44″ drivers. In all, the leading wheels were held in a rigid frame and placed behind the cylinders. The arrangement originated with James Milholland, Master of Machinery of the Philadelphia & Reading R. R. and was first used on the "Pawnee" class, built by that road in 1852. It was a new design but the true Mogul did not come until a decade later.

Between 1853 and 1856, Ross Winans built eleven "Camel" locomotives for the road. These had 19x22″ cylinders, 42 or 44″ drivers and weighed around 59,000 pounds. With their long overhanging fireboxes, firing chutes and cam operated valve gear, all were subse-

quently rebuilt to 2-6-0 type locomotives at Altoona and, as such, remained in service until the early 1880's.

Of the Norris engines, the majority of them up to this time were of the 4-4-0 type with varying sizes of drivers and weight of engine. Altho' the Norris engines had a reputation for being very fast, their frames were of light construction and some of their boilers were poorly stayed, resulting in explosions. In 1856 Norris delivered two 4-4-0 type locomotives, 16x24" cylinders, 66" drivers which were an improvement over those previously delivered. They were probably the first Norris engines to be fitted with the Stephenson link motion—the first Baldwin locomotive to be fitted with this same motion was the "Tiger," built the same year.

Mention might be made at this point of the substitution of coal for wood as fuel. These experiments were made under the supervision of Enoch Lewis, then Second Assistant Superintendent, in 1853. Enoch Lewis was born of Quaker parents in Wilmington, Delaware, on Dec. 1st, 1821. At the age of fifteen he commenced his apprenticeship with Eastwick & Harrison of Philadelphia, remaining with them between 1836 to 1842. In 1844, still in the employ of Eastwick & Harrison, he went to Russia to take charge of a shop at Alexandroffsky, near St. Petersburg, to supervise the construction of cars for the St. Petersburg & Moscow R. R. He returned to the United States in 1846. Between the time of his return and 1850, he filled various positions and, part of the time was spent at Ballardvalle, Mass., in the building of locomotives. In 1850, he entered the service of the P. R. R. and was in charge of the roundhouse and shop at Mifflin. In 1851 he went into the office of the superintendent at Harrisburg and on Dec. 1, 1852, he was made Second Assistant Superintendent, in charge of the Middle Division and of motive power, being located at Altoona. He subsequently became purchasing agent of the road, a position he held until his retirement on Dec. 1, 1893.

The results of his experiments were found to be favorable for coal, if mixed with wood. In 1859, a more elaborate test was made on six locomotives, the idea was to find out if bituminous coal could be used in passenger service without creating objectionable smoke—all passenger locomotives at the time burned wood. The tests proved that it was possible to use this fuel for this service provided the boilers were properly fitted to burn same. A new series of tests were started with locomotive No. 156, a new Baldwin engine built in 1859. Equipped with a deep firebox, long combustion chamber, baffle plates and short tubes, this design known as a Smith boiler demonstrated that one pound of Pittsburgh coal to be equivalent to 2.31 pounds of hard wood and one net ton of Pittsburgh coal equal to 1¾ cords of hard wood. These experiments were in line with what was going on on other roads. We must not forget that G. S. Griggs, Master Mechanic of the Boston & Providence R. R. was the father of the brick arch, as we know it today and he commenced his experiments in 1857. We should also remember that the "Daniel Webster," built by the Taunton Locomotive Works for the

Philadelphia, Wilmington & Baltimore R. R. in 1857, was the first successful coal burning locomotive in the country. The Pennsylvania continued their experiments with various designs of boilers and various equipment and perhaps it was at this point that they learned that the success of burning coal depended as much upon the skill of the fireman as upon a fire box filled with expensive devices.

Further digression concerns Altoona, Pennsylvania. Here, on the eastern slope of the Allegheny Mountains, the road established its main repair shops. Altoona became famous as early as 1860 and, during all of these years, these shops have been added to and modernized in every way. The products of these shops have been generally recognized because of their excellence and from these shops have graduated future officials of the motive power department and the road, among them being Samuel M. Vauclain, later President of the Baldwin Locomotive Works.

John P. Laird of Northern (N. H.) R. R. fame, later identified with the Latham Works at White River Jct., Vermont, was appointed Master of Machinery on June 15, 1862, a position he held until May, 1866. Mr. Laird was an engineer of considerable ability. He designed a balloon shaped stack with a spark arrester that was a great success on coal burning locomotives. He is best known for his two-bar guide which was used on some of the heaviest engines built within recent years. It was during the Civil War period, with the Baltimore & Ohio R. R. suffering from the Confederate raids, that the brunt of this war business was carried by the Pennsylvania. There was a vital need for locomotives which meant that repairs must be made as speedily as possible. With its own variety of locomotives from the different builders should be added those from the state owned road, acquired in 1857. Mr. Laird saw the need of some kind of standardization and in his rebuilding and modernizing of the older locomotives. he carried that out as far as possible.

The locomotives were roughly divided into two classes, according to their service. The 4-4-0 was generally used for passenger service, with horizontal cylinders, spread truck wheels, Stephenson link motion, plain slide valves, wagon top boiler and firebox hung between the driving axles. The freight locomotive was of the 4-6-0 type, much the same only a third pair of drivers was placed between the leading truck and leading drivers of the passenger engine. The largest passenger locomotives had 17x24″ cylinders and drivers from 60 to 66 inches in diameter. The heavy ten-wheelers for freight service had 18x22″ cylinders and 54″ drivers. Injectors had been substituted for pumps and, prior to the introduction of the air brake, this road used the Loughridge chain brake. A friction wheel which could be pulled up against the rear driving wheel of the locomotive when in motion, was caused to rotate and wind up a chain on a drum and the pull of this chain was transmitted to the brake shoes on the train. Altho' it had its imperfections, it acted with more speed than the hand brakes and was better than some other devices on the market.

The use of steel for locomotive fireboxes commenced to be used in 1861. In that year, Baldwin imported some English steel with probably

too high carbon content. At any rate, these plates cracked when fitting them to the boilers and it was necessary to substitute copper. P. R. R. Nos. 231 and 232, delivered January, 1862, were fitted with American homogeneous cast steel for their fireboxes and, they seemed to be a success. These were 4-6-0 type freight locomotives, with combustion chambers 36″ deep and all of the firebox, with the exception of the tube sheets which were of copper, were built of steel plates. Steel boiler shells followed in 1868 and were used on the ten-wheelers.

The first application of the four-wheel swing-bolster truck by the Baldwin Works was in 1867 to a group of 4-4-0 type passenger engines with 17x24″ cylinders, 66″ drivers and bore road numbers 419-422. The last engine was placed in service September 9, 1867 and was not shopped until May 14, 1871. Between the time of delivery and the time of shopping, the locomotive had rolled up a total of 153,280 miles. And, it should be noted, that the gay brass work and fancy colors were giving way to the somber black and absence of decorations.

The road was growing in size and, the selection of roads that would fit in with the plan of growth is a reflection on the good judgment of J. Edgar Thomson and the directors of the road. One of the first roads acquired (1860), was the Northern Central, extending from Baltimore, through Harrisburg to Sunbury, Pa. At this point a connection was made with the Philadelphia & Erie, a road that tapped the oil regions and extended to Erie, Pa. This road was leased Jan. 1, 1862. In 1873, the Baltimore & Potomac was completed and acquired and this road, gave the Pennsylvania a through line to Washington from the Great Lakes and the West. West of Pittsburgh, several smaller lines were acquired and welded into larger roads that were either leased or came under P. R. R. control. The Pittsburgh, Ft. Wayne & Chicago Ry., gave the road their own line from Pittsburgh to Chicago and the Pittsburgh, Cincinnati, Chicago & St. Louis gave them entrance to Cincinnati and St. Louis. All of these acquired railroads added to the responsibilities of the Motive Power Department.

John P. Laird resigned as Master of Machinery in May, 1866 and was succeeded by R. E. Ricker. In 1867, he was succeeded by Alexander J. Cassatt and, it was to Mr. Cassatt that the road owed its early start in the standardization of its locomotives. In the interests of operating efficiency as well as in economy of operation, complete drawings of a series of standard locomotives were prepared in 1868 at Altoona and from that time to the present, all of the steam locomotives, whether built in the company shops or by outside builders have conformed to these designs which will be discussed in the next article.

Pennsylvania Railroad Locomotive Roster 1847-1869

This roster is based on the rosters of the locomotives that appear in the annual reports of this company and it has been prepared by our member—Mr. H. E. Nichols. The report for 1850 contains the first roster; the one for 1854 shows the assignment to the Eastern and

Western Divisions and the one for 1857 includes those of the Philadelphia Division, formerly the Philadelphia & Columbia R. R. and, the assignment of numbers to the locomotives. Names were removed from their locomotives by 1858 and, by 1862, because of its length, the list was discontinued from these reports. Builder's lists and additional data have supplemented these reports to continue the roster. Also, at the outset, these reports did not include the dimensions of the cylinders and they failed to show the wheel arrangement. This list is arranged in the order of their original assignment and locomotives that replaced any in this list will follow in a separate roster.

Penrose	Baldwin	84	6-1837	?-2-?	11½x16"	54"	24225
Dauphin	Baldwin	333	11-1848	0-8-0	17x22"	43"	50975
Harrisburg	Baldwin	64	2-1837	?-2-?	10½x16"	54"	23900
Perry	Baldwin	334	11-1848	0-8-0	17x22"	43"	50975
Porter	Norris		?	?-2-?	?	48"	23250
Luzerne	Baldwin	565	12-1853	4-4-0	17x22"	54"	48000
Lehigh	Baldwin	566	12-1853	4-4-0	17x22"	54"	48000

The "Penrose" and "Harrisburg" were built originally for the Harrisburg, Portsmouth, Mt. Joy & Lancaster R. R. and the date shown in the annual reports, 1849, is the date that road was acquired by the P. R. R. The "Dauphin" and "Perry" were sold to the Philadelphia & Reading R. R. and the "Luzerne" and "Lehigh" were sold to the Commonwealth in March, 1854 and were retaken and numbered 168 and 167 respectively. None of the above locomotives carried numbers on the P. R. R.

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1 Clay	Norris		10-1849	?-2-?		48"	23350
2*Heisley	Norris		10-1851	?-4-?		48"	26600
3*Franklin	Baldwin	306	10-1849	4-4-0	11⅜x18"	48"	30650
4*Washington	Baldwin	293	10-1849	0-6-0	13x18"	42"	34675
5 Mifflin	Baldwin	356	7-1849	?-2-?	14x20"	72"	47800
6 Blair	Baldwin	371	12-1849	?-2-?	14x20"	72"	47800
7 Juniata	Baldwin	369	10-1849	4-4-0	14x20"	54"	45275
8 Huntington	Baldwin	370	11-1849	4-4-0	14x20"	54"	45275
9 Cambria	Norris		1-1850	?-4-?	13x24"	54"	40825
10 Indiana	Baldwin	372	12-1849	?-2-?	14x20"	72"	48750
11 Allegheny	Baldwin	385	6-1850	4-4-0	14½x20"	54"	45275
12 Clarion	Baldwin	386	6-1850	4-4-0	14½x20"	54"	45275
13 Clinton	Baldwin	387	8-1850	4-4-0	15x20"	54"	44800
14 Westmoreland	Baldwin	357	4-1850	0-8-0	17x22"	43"	50975
15 Beaver	Baldwin	388	8-1850	0-8-0	14½x18"	42"	43350
16 Columbia	Baldwin	389	8-1850	4-4-0	15x20"	54"	44800
17 Erie	Baldwin	392	9-1850	4-4-0	15x20"	54"	44800
18 Elk	Baldwin	390	8-1850	4-4-0	15x20"	54"	44800
19 Venango	Baldwin	400	10-1850	4-4-0	15x20"	54"	44800
20 Wyoming	Baldwin	404	11-1850	4-4-0	13½x22"	60"	38675
21 Centre	Baldwin	406	11-1850	4-4-0	15x20"	54"	44800
22 Armstrong	Baldwin	407	12-1850	4-4-0	13½x22"	60"	38675
23 Crawford	Baldwin	431	6-1851	4-4-0	15x20"	54"	45900
24 Clearfield	Baldwin	423	5-1851	4-4-0	15x20"	54"	45900
25 Bradford	Baldwin	459	12-1851	4-4-0	15x20"	54"	45900

26 Butler	Baldwin	460	1-1852	4-4-0	13½x22"	60"	38675
27 Somerset	Baldwin	464	2-1852	4-4-0	15x20"	54"	47400
28 Fayette	Baldwin	462	2-1852	4-4-0	15x20"	54"	47400
29 Susquehanna	Baldwin	465	3-1852	4-4-0	13½x22"	60"	38675
30 Greene	Baldwin	468	3-1852	4-4-0	15x20"	54"	46400
31 Lycoming	Baldwin	470	3-1852	4-4-0	15x20"	54"	46400
32 Pike	Baldwin	471	4-1852	4-4-0	15x20"	60"	47400
33 Union	Baldwin	478	5-1852	4-4-0	15x20"	60"	47400
34 Dauphin	Baldwin	488	8-1852	4-6-0	18x22"	44"	64500
35 Laurence	Baldwin	490	9-1852	4-6-0	18x22"	44"	64500
36 Antelope	Wilmarth		10-1852	4-4-0	16x22"	78"	61300
37 Lebanon	Baldwin	498	10-1852	4-6-0	18x22"	44"	64500
38 Mercer	Baldwin	497	10-1852	4-6-0	18x22"	44"	64500
39 Berks	Baldwin	499	10-1852	4-6-0	18x22"	44"	64500
40 Atalanta	Wilmarth		11-1852	4-4-0	16x22"	78"	59000
41 Latrobe	Smith & Perkins		12-1852	2-6-0	17x22"	44"	54200
42 Cumberland	Baldwin	505	12-1852	2-6-0	18x22"	44"	59600
43 Altoona	Smith & Perkins		12-1852	2-6-0	17x22"	44"	54200
44*Jefferson	Baldwin	506	12-1852	2-6-0	18x22"	44"	59600
45*Northumberland	Baldwin	507	12-1852	2-6-0	18x22"	44"	59600
46 Lancaster	Baldwin	508	12-1852	2-6-0	18x22"	44"	59600
47 Schuylkill	Baldwin	509	1-1853	2-6-0	18x22"	44"	59600
48 Pluto	Ross Winans		1-1853	0-8-0	19x22"	44"	59100
49 York	Baldwin	510	1-1853	2-6-0	18x22"	44"	59600
50 Vulcan	Ross Winans		2-1853	0-8-0	19x22"	44"	58500
51 Cyclops	Ross Winans		2-1853	0-8-0	19x22"	44"	61700
52 Thor	Ross Winans		4-1853	0-8-0	19x22"	44"	59150
53 Eagle	Wilmarth		4-1853	4-4-0	16x22"	66"	57600
54 Tuscarora	Norris	628	5-1853	4-4-0	16x24"	72"	58500
55 Kittanning	Norris		5-1853	4-4-0	16x24"	72"	58500
56 Conemaugh	Norris		5-1853	4-4-0	16x24"	72"	58500
57 Kiskiminitas	Norris		5-1853	4-4-0	16x24"	60"	56700
58 Youghiogeny	Norris		6-1853	4-4-0	16x24"	60"	56700
59 Monongahela	Norris		6-1853	4-4-0	16x24"	60"	56700
60*Sewickley	Norris		7-1853	4-4-0	16x24"	60"	54800
61*Crab Tree	Norris		8-1853	4-4-0	16x24"	60"	54800
62 Quemahoning	Norris		8-1853	4-4-0	16x24"	60"	54800
63 Philadelphia	Smith & Perkins		9-1853	2-6-0	17x24"	44"	55800
64 True American	Baldwin	546	8-1853	4-4-0	16x22"	66"	57400
65 Kishocoquillas	Norris		9-1853	4-4-0	16x24"	60"	54800
66 Adams	Baldwin	547	9-1853	4-4-0	17x22"	54"	59700
67 Bucks	Baldwin	548	9-1853	4-4-0	17x22"	54"	59700
68 Bald Eagle	Norris		10-1853	4-4-0	16x24"	60"	54800
69 Carbon	Baldwin	550	9-1853	4-4-0	17x22"	54"	59700
70 Chester	Baldwin	551	9-1853	4-4-0	17x22"	54"	59700
71 Loyalhanna	Norris	649	10-1853	4-4-0	16x24"	60"	54800
72 Delaware	Baldwin	553	10-1853	4-4-0	17x22"	54"	59700
73 Forest	Baldwin	554	10-1853	4-4-0	17x22"	54"	59700
74 Pittsburgh	Smith & Perkins		10-1853	2-6-0	17x22"	44"	55800
75 Fulton	Baldwin	556	10-1853	4-4-0	17x22"	44"	59700
76 Greensburg	Smith & Perkins		11-1853	2-6-0	17x22"	44"	55800
77 Johnstown	Smith & Perkins		12-1853	2-6-0	17x22"	44"	55800
78 Blairsville	Smith & Perkins		12-1853	2-6-0	17x22"	44"	55800
79 Nittany	Norris		1-1854	4-4-0	16x24"	54"	54900
80*Black Log	Norris		1-1854	4-4-0	16x24"	54"	54900
81 Warrior Ridge	Norris		1-1854	4-4-0	16x24"	54"	54900
82 Bolivar	Smith & Perkins		1-1854	2-6-0	17x22"	44"	54800
83 McKean	Baldwin	568	12-1853	4-4-0	17x22"	54"	59700
84 Mahoney	Norris		1-1854	2-6-0	16x24"	54"	54900

85 Nescopeck	Norris		1-1854	4-4-0	16x24"	54"	54900
86 Nanticoke	Norris		2-1854	4-4-0	16x24"	54"	54900
87 Chestnut Ridge	Norris		2-1854	4-4-0	16x24"	54"	54900
88 Mountaineer	Ross Winans		2-1854	0-8-0	19x22"	44"	61200
89 Ninevah	Smith & Perkins		2-1854	2-6-0	17x22"	44"	54800
90*Laurel Hill	Norris		2-1854	4-4-0	16x24"	54"	54900
91 Logan	Ross Winans		2-1854	0-8-0	19x22"	44"	59150
Rebuilt	Altoona		1867	2-6-0			
92*Kittatiny	Norris		2-1854	2-6-0	17x22"	44"	55600
93 Wilkinsburg	Smith & Perkins		2-1854	2-6-0	17x22"	44"	55800
94 Quaker City	Baldwin	573	2-1854	0-8-0	19x22"	44"	62100
95 Iron City	Baldwin	574	2-1854	0-8-0	19x22"	44"	62100
96*Allegrippus	Norris		3-1854	2-6-0	17x22"	44"	55600
97 Pennsylvania	Baldwin	575	2-1854	0-8-0	19x22"	44"	62100
98 Bedford	Baldwin	577	3-1854	0-8-0	19x22"	44"	66000
99 St. Clair	Smith & Perkins		3-1854	2-6-0	17x22"	44"	61375
100 Montgomery	Baldwin	580	3-1854	4-4-0	17x22"	54"	59700
101 Ligonier	Smith & Perkins		4-1854	2-6-0	17x22"	44"	55800
102 Montour	Baldwin	582	3-1854	4-4-0	17x22"	54"	59700
103 Monroe	Baldwin	584	4-1854	4-4-0	17x22"	54"	59700
104 Northampton	Baldwin	585	4-1854	4-4-0	17x22"	54"	59700
105 Perry	Baldwin	586	4-1854	4-4-0	17x22"	54"	59700
106 Potter	Baldwin	587	4-1854	4-4-0	17x22"	54"	59700
107 Blazing Star	Baldwin	592	5-1854	4-4-0	16x22"	66"	57600
108 Chamois	Baldwin	595	6-1854	4-4-0	16x22"	66"	57600
109 Gazelle	Baldwin	602	7-1854	4-4-0	16x22"	66"	57600
110 Sullivan	Baldwin	605	8-1854	4-4-0	17x22"	54"	62400
111 Tioga	Baldwin	606	8-1854	4-4-0	17x22"	54"	62400
112 West Wind	Baldwin	611	8-1854	4-4-0	16x22"	66"	57600
113 Warren	Baldwin	620	10-1854	4-4-0	17x22"	54"	59700
114 Wayne	Baldwin	622	10-1854	4-4-0	17x22"	54"	59700
115 Belle	Baldwin	626	12-1854	4-4-0	16x22"	72"	58350
116 Flirt	Baldwin	629	12-1854	4-4-0	16x22"	72"	61900
117 Black Oak	Baldwin	642	5-1855	4-6-0	19x22"	48"	61000
118 Aughwick	Baldwin	670	11-1855	4-6-0	19x22"	48"	61000
119 Corn Planter	Ross Winans		1-1856	0-8-0	19x22"	44"	58500
120 Blue Ridge	Baldwin	679	1-1856	4-6-0	19x22"	48"	70000
121 Red Jacket	Ross Winans		1-1856	0-8-0	19x22"	44"	59500
122 Lehigh	Baldwin	681	1-1856	4-4-0	17x22"	54"	59700
123 Luzerne	Baldwin	682	2-1856	4-4-0	17x22"	54"	59700
124 Oneida	Ross Winans		2-1856	0-8-0	19x22"	44"	58500
125 Tionesta	Baldwin	684	2-1856	4-4-0	17x22"	54"	59700
126 Snyder	Baldwin	685	2-1856	4-4-0	17x22"	54"	59700
127*Wilmore	Smith & Perkins		4-1856	?-6-?	?	44"	60600
128*Cresson	Smith & Perkins		4-1856	?-6-?	?	44"	60600
129*Gallitzin	Smith & Perkins		4-1856	?-6-?	?	44"	60600
130 Mohawk	Ross Winans		4-1856	0-8-0	19x22"	44"	59150
131 Seneca	Ross Winans		4-1856	0-8-0	19x22"	44"	59150
132*Wyalusing	Norris		7-1856	4-4-0	16x24"	66"	——
132 Hornet	Baldwin	761	5-1857	4-4-0	15¼x24"	66"	61900
133*Shamokin	Norris		7-1856	4-4-0	16x24"	66"	——
133 Wasp	Baldwin	763	6-1857	4-4-0	15¼x24"	66"	61300
134 Tiger	Baldwin	731	12-1856	4-4-0	15x24"	66"	59100
135 Leopard	Baldwin	736	12-1856	4-4-0	15x24"	66"	59100
136-137 Not Named	Baldwin	766-767	6-1857	4-4-0	17x22"	56"	65000
138-139 Not Named	Baldwin	769-770	7-1857	4-4-0	17x22"	56"	65000
140*Consolidation	Baldwin	754	4-1857	?-6-?	14½x18"	44"	45850

* The early reports of this company give the disposition of many of these engines:

"Heisley" formerly the "Porter" rebuilt in 1851.

"Franklin" and "Washington," both acquired from the Harrisburg, Portsmouth, Mt. Joy & Lancaster R. R. They were built in August and February, 1847, respectively and the date on the roster is the date they were acquired by the P. R. R.

"Jefferson" and "Northumberland," sold to the Steubenville & Indiana R. R. in 1856.

"Sewickley" and "Crab Tree," sold to the U. S. Gov't in 1861.

"Black Log" and "Laurel Hill," transferred to Philadelphia & Erie R. R. in 1861 or 1862.

"Kittatiny" and "Allegrippus," sold to Steubenville & Indiana R. R. in 1858.

"Wilmore," loaned to the Steubenville & Indiana R. R. in 1857 and to the Pittsburgh, Columbus & Cincinnati R. R. in 1858.

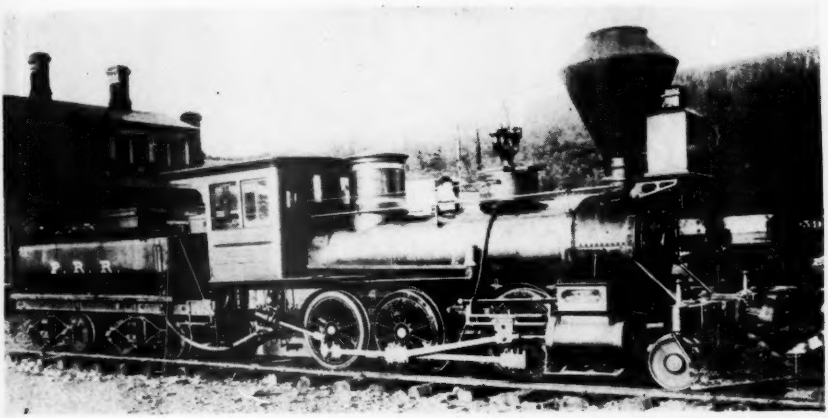
"Cresson" and "Gallitzin," sold to the Steubenville & Indiana R. R. in 1856.

"Wyalusing" and "Shamokin," sold to the Pittsburgh, Ft. Wayne & Chicago Ry. in 1856.

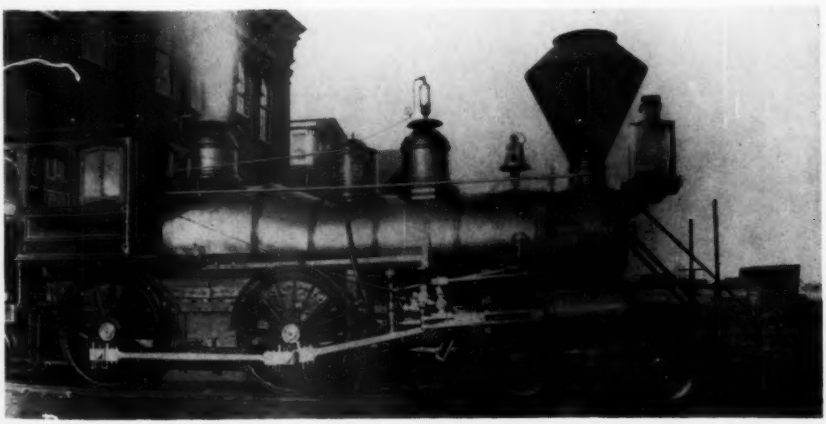
"Consolidation," transferred to the Philadelphia & Erie R. R. in 1861.

The following group of locomotives were received from the Philadelphia & Columbia R. R. in 1857:

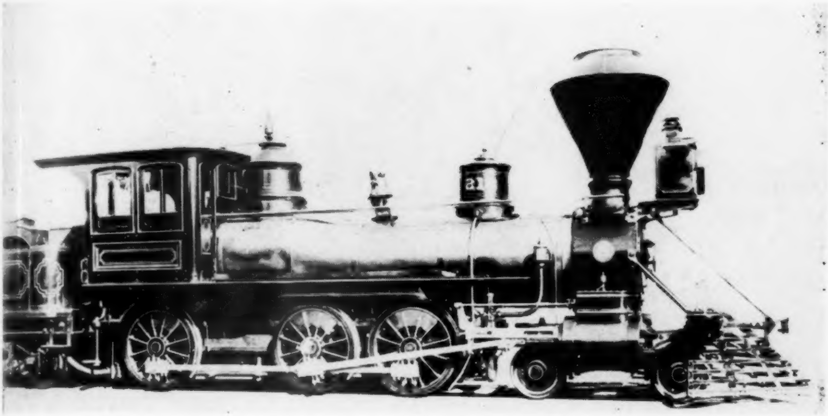
141 Brandywine	Baldwin	18	10-1835	4-2-0	10x18"	—	20000
142 Atlas	Baldwin	232	4-1845	0-6-0	14x18"	42"	33000
143 Lewistown	Baldwin	291	3-1847	0-6-0	13½x18"	42"	33000
144 Tioga	Norris		5-1848	4-4-0	12½x22"	48"	38000
145*Venango	Norris		6-1848	4-4-0	12½x22"	48"	38000
146*F. R. Shunk	Norris		3-1849	4-4-0	?	54"	40800
147 Wyoming	Norris		5-1849	4-4-0	11x26"	60"	40200
148 Wissahickon	Norris		5-1849	4-4-0	11x26"	60"	40200
149 Clarion	Norris		10-1849	4-4-0	12½x24"	54"	40800
150 Shawnee	Norris		11-1849	4-4-0	12½x24"	54"	40800
151 Swatara	Norris		12-1849	4-4-0	12½x24"	54"	40800
152*Wyalusing	Norris		3-1850	4-4-0	?	60"	40200
153*Tuscarora	Norris		4-1850	4-4-0	?	60"	40200
154 Constitution	Norris		1-1851	4-4-0	11x20"	60"	41600
155 Union	Norris		2-1851	4-4-0	11x20"	60"	41600
156*Columbia	Norris		5-1851	4-4-0	?	54"	40800
157 Lancaster	Norris		5-1851	4-4-0	12½x24"	54"	40800
158 Jesse Miller	Norris		4-1851	4-4-0	12½x24"	54"	40800
159 Keystone	Lancaster L W		6-1853	4-4-0	16x22"	60"	53000
160 Conowingo	Lancaster L W		7-1853	4-4-0	16x22"	60"	53000
161 Utah	Lancaster L W		7-1853	4-4-0	16x22"	60"	53000
162 Minnesota	Lancaster L W		8-1853	4-4-0	16x22"	60"	53000
163 Clearfield	Lancaster L W		9-1853	4-4-0	16x22"	60"	53000
164 Clinton	Lancaster L W		9-1853	4-4-0	16x22"	60"	53000
165 Atalanta	Lancaster L W		9-1853	4-4-0	16x20"	66"	55200
166 Wheatland	Lancaster L W		11-1853	4-4-0	16x20"	66"	55200
167 Lehigh	Baldwin	566	12-1853	4-4-0	17x22"	54"	48000
168 Luzerne	Baldwin	565	12-1853	4-4-0	17x22"	54"	48000
169 President	Norris		4-1854	4-4-0	16x22"	60"	62000



P. R. R. #210, Smith & Perkins 1853. Cyl. 18x24", Drivers 48", Wt. of locomotive 66000 lbs. Shown as rebuilt 1863. Note the safety valves, "buckhorns," with whistle in between atop the sand dome.

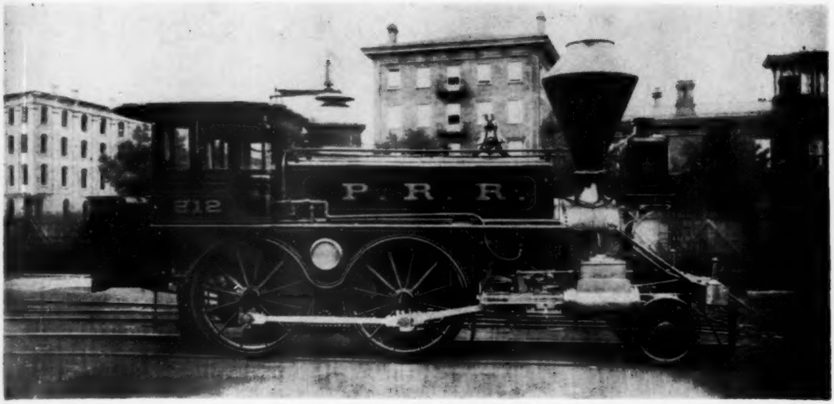


P. R. R. #145. Lancaster L. W. 1860. Cyl. 18x22", Drivers 60", Wt. of locomotive 63000 lbs. For passenger service.

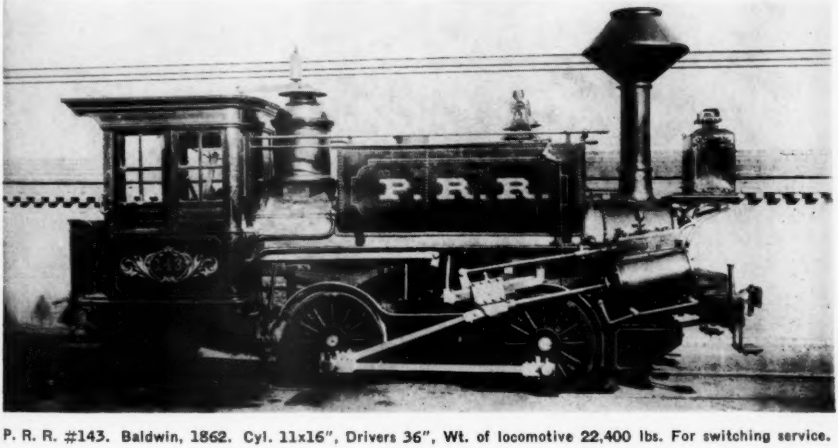


P. R. R. #218. Baldwin 1861. Cyl. 18x22", Drivers 48", Wt. of locomotive 66000 lbs. For freight service.

P. R. R. #216. Baldwin, 1861. Cyl. 15x18", Drivers 44", Wt. of locomotive 44,800 lbs. For switching service.



P. R. R. #212. Baldwin 1861, Cyl. 10x18", Drivers 56", Wt. of locomotive 42,800 lbs. For light passenger service.



P. R. R. #143. Baldwin, 1862. Cyl. 11x16", Drivers 36", Wt. of locomotive 22,400 lbs. For switching service.

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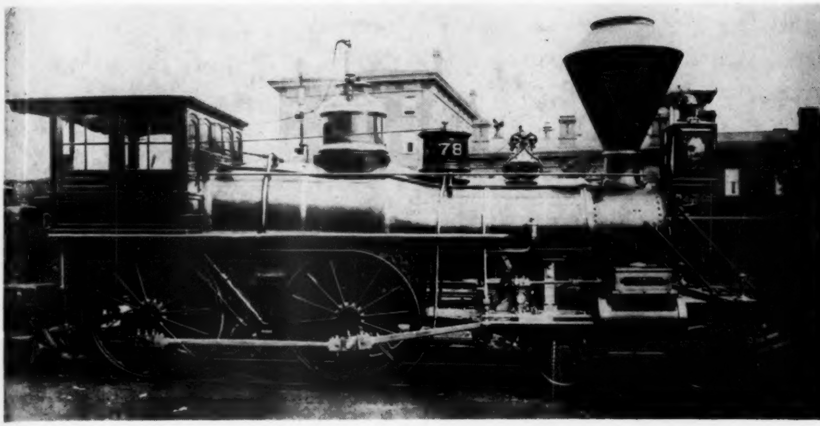
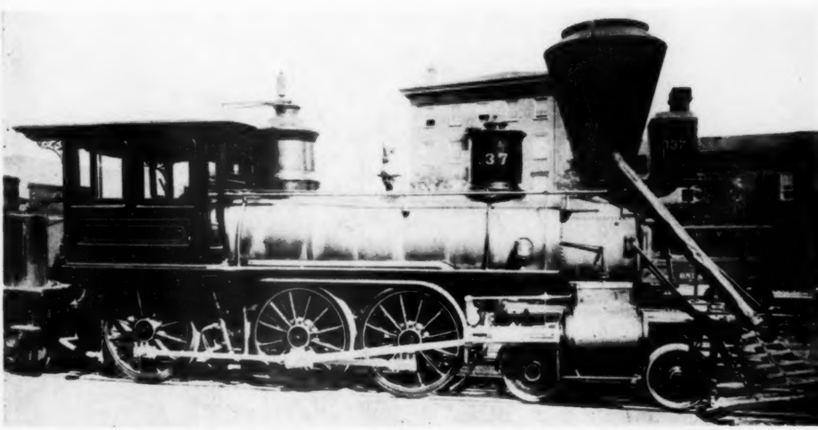


P. R. R. #278. Richard Norris & Son 1863. Cyl. 17x24", Drivers 66", Wt. of locomotive 67,200 lbs. For passenger service. Note decorative headlight.



P. R. R. #137. Baldwin 1864. Cyl. 18x22", Drivers 54", Wt. of locomotive 62,720 lbs. One of twenty engines from this builder for freight service.

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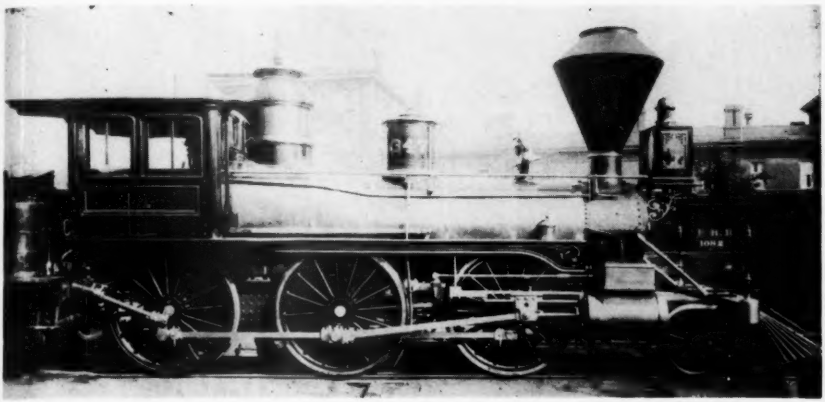
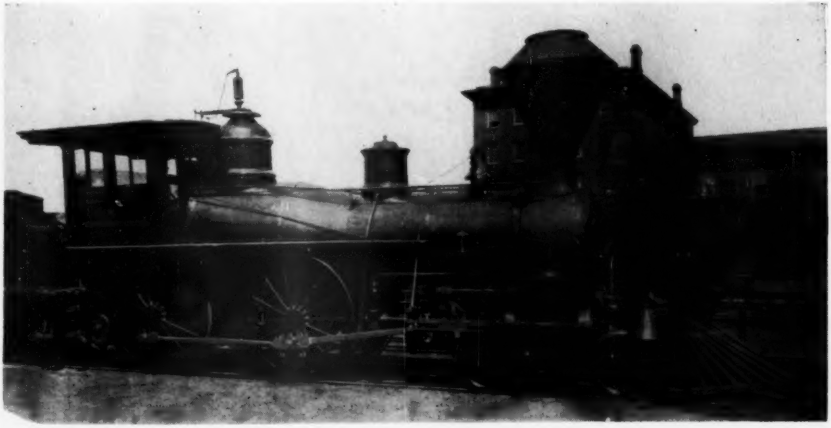
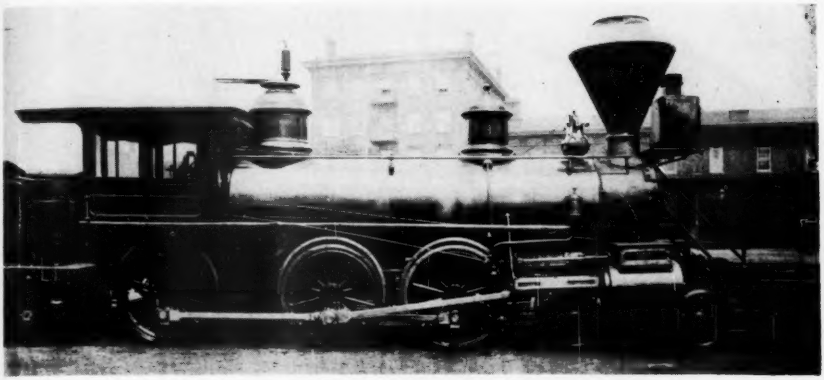


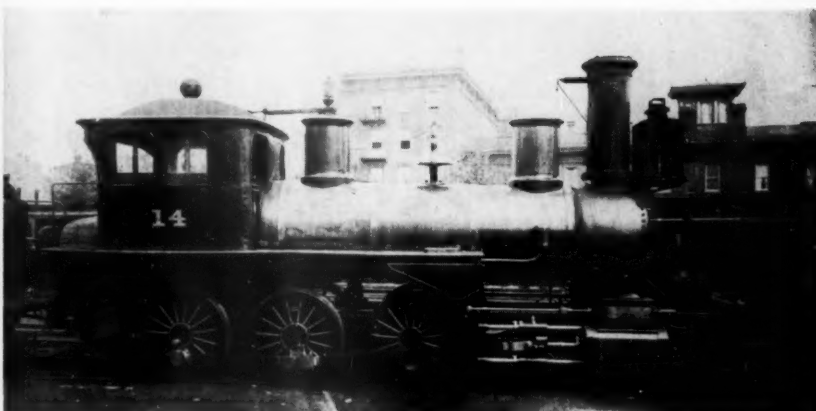
P. R. R. #347. Richard Norris & Son 1865. Cyl. 19x24", Drivers 66", Wt. of locomotive 64,300 lbs. Originally of the 4-4-0 type, rebuilt in 1870 to 2-6-0 type for passenger service.



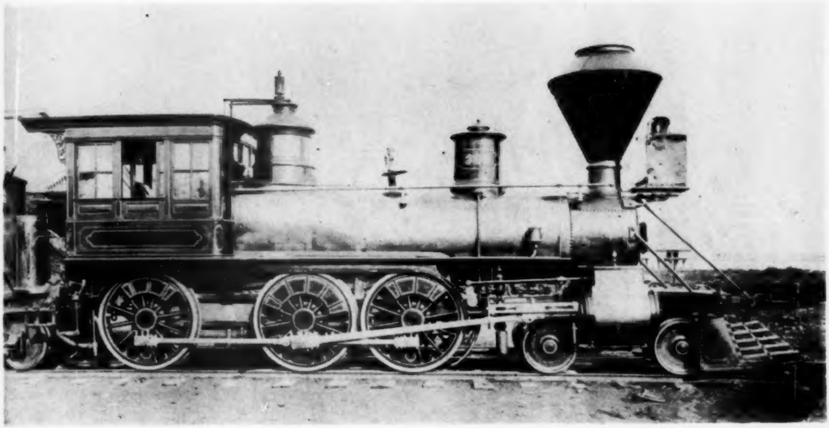
P. R. R. #348. Richard Norris & Son 1865. Cyl. 17x24", Drivers 66", Wt. of locomotive 67200 lbs. One of the last locomotives built by this firm in Philadelphia before moving to Lancaster, Pa.



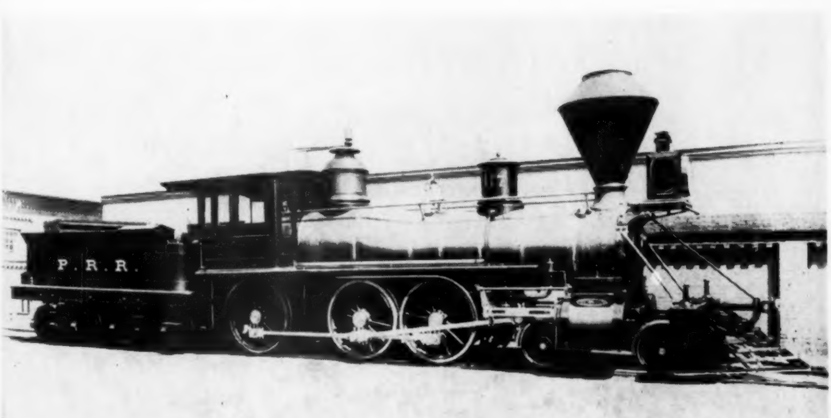
P. R. R. #283. New Jersey L & M Co. 1865. Cyl. 18x22". Drivers 54".



P. R. R. #14. Norris—Lancaster 1866. Cyl. 19x24", Drivers 48", Wt. of locomotive 70,000 lbs. Built for freight service and patterned after James Millholland's "Gunboats" on the Phila. & Read. R. R.



P. R. R. #383. Baldwin 1866. Cyl. 18x22", Drivers 55". Wt. of locomotive 70,000 lbs. One of twelve locomotive built for freight service.



P. R. R. #417. New Jersey L. & M. Co. 1867. Cyl. 18x22", Drivers 54", Wt. of locomotive 73000 lbs. One of ten engines for freight service.

170 Governor	Norris		4-1854	4-4-0	16x22"	60"	62000
171 Kansas	Baldwin	588	4-1854	4-4-0	16x22"	60"	54400
172 Shanghai	Lancaster L W		5-1854	4-4-0	16½x20"	66"	56800
173*Nebraska	Baldwin	590	5-1854	4-4-0	16x22"	60"	54400
174 Old Hickory	Norris		5-1854	4-4-0	18x22"	60"	67200
175 John Gilpin	Lancaster L W		6-1854	4-4-0	16½x20"	66"	56800
176 Tam O'Shanter	Lancaster L W		12-1854	4-4-0	16x22"	60"	57000
177 Uncle Toby	Lancaster L W		1-1855	4-4-0	16x22"	60"	57000
178 Bardolph	Lancaster L W		5-1855	4-4-0	16x22"	60"	57000
179 Old Fogy	Lancaster L W		5-1855	4-4-0	16x22"	60"	57000
180 Young America	Lancaster L W		10-1855	4-4-0	16½x22"	60"	58400
181 Atilla	Lancaster L W		12-1855	4-4-0	17x20"	66"	59200
182 Alaric	Lancaster L W		2-1856	4-4-0	17x20"	60"	58400
183 Tony Weller	Lancaster L W		2-1856	4-4-0	16½x22"	60"	58400
184 My Son Samuel	Lancaster L W		5-1856	4-4-0	16½x22"	60"	58400
185 Yorick	New Jersey L W		3-1856	4-4-0	16x22"	54"	53000
186 Alert	Lancaster L W		4-1856	4-4-0	16½x22"	60"	58400
187 Corporal Trim	New Jersey L W		4-1856	4-4-0	16x22"	54"	53000
188 Fingall's Baby	Lancaster L W		6-1856	4-4-0	18x22"	60"	66000
189 Falstaff	Lancaster L W		6-1856	4-4-0	18x22"	60"	66000
190*Old Dominion	Norris		6-1856	4-4-0	18x22"	60"	67000
191 Hoosier State	Norris		7-1856	4-4-0	18x22"	60"	67200
192 Washington	Norris		7-1856	4-4-0	18x22"	60"	67200
193 Buchanan	Lancaster L W		8-1856	4-4-0	18x22"	60"	66000
194 Hiawatha	Lancaster L W		2-1857	4-4-0	16¼x22"	66"	60000
195 Breckenridge	Lancaster L W		2-1857	4-4-0	16¼x22"	66"	60000
The following locomotives were received from the Allegheny Portage R. R.							
196 Cambria	Norris		——	?-4-?	?	54"	38500
197*Cherokee	Norris		8-1851	4-4-0	11x24"	54"	39200
198 Westmoreland	Norris		11-1851	?-4-?	?	54"	?
199*Juniata	Norris		8-1851	4-4-0	10½x20"	54"	?
200 Pittsburgh	Smith & Perkins		——	2-6-0	17x22"	44"	61500
201 Philadelphia	Smith & Perkins		——	2-6-0	17x22"	44"	61500
202 Bedford	Baldwin	487	8-1852	4-6-0	18x22"	44"	65500
203 Montgomery	Norris		1850	4-4-0	13x24"	54"	?
204 Jupiter	Norris		6-1854	2-6-0	17x24"	48"	60800
205 Hercules	Norris		4-1854	2-6-0	17x24"	48"	64800
206 Wm. Hopkins	Baldwin	688	3-1856	4-6-0	19x22"	48"	64000
207 Ts. H. Forsythe	Baldwin	640	3-1855	4-6-0	19x22"	48"	64900
208 Blair	Norris		4-1854	2-6-0	17x24"	48"	59500
209 W. T. Morrison	Norris		4-1854	2-6-0	17x24"	48"	59500
210*Lycoming	Norris		1850	?-4-?	?	54"	?
210	Norris	912	10-1858	2-6-0	16x24"	49"	65300
211 C. E. Spangler	Baldwin	792	11-1857	0-6-0	14½x18"	44"	47400
—*Novelty	Baldwin	912	2-1860	2-2-0	5x12"	42"	4000

This completes the roster of locomotives that carried names on the P. R. R.

* The following shows the disposition of these engines:

"Venango" and "Wyalusing," sold to the Delaware & Raritan Bay R. R. in 1858.

"F. R. Shunk" and "Columbia" sold to the Lackawana & Bloomsburg R. R. in 1857.

"Tuscarora," sold to the Delaware & Raritan Bay R. R. in 1859.

"Nebraska," sold to Richmond & Danville R. R. 6-1875.

"Old Dominion" was rebuilt by Baldwin with a Dimpfel boiler in 1857.

"Cherokee," sold to Allegheny Valley R. R. in 1861.
"Juniata," transferred to Philadelphia & Erie R. R. in 1861.
"Lycoming," sold to Keokuk & Warsaw R. R. in 1857.
"Novelty," sold to Pittsburgh, Ft. Wayne & Chicago R. R. in 1860.

The date of sale of all of these engines is taken from the annual report of the year following thus, the engines may have been sold the year previous to the report or they could have been sold early in the year of that report.

Let us list the replacements to the above locomotives:

1	Baldwin	1009	9-1861	4-6-0	18½x22"	48"	66000
2	Baldwin	1283	9-1864	4-6-0	18x22"	54"	62720
3	Baldwin	994	3-1861	4-6-0	18½x22"	50"	66000
4	Baldwin	1010	9-1861	4-6-0	18½x22"	48"	66000
3rd 4	Altoona	25	6-1869	4-6-0		G-2	
5	Baldwin	1446	1-1866	4-6-0	18x22"	54"	62720
6	Baldwin	1312	11-1864	4-6-0	18x22"	54"	62720
10	Baldwin	1313	11-1864	4-6-0	18x22"	54"	62720
11	Altoona	34	8-1869	4-4-0		D-3	
13	Altoona	16	4-1869	4-4-0		D-1	
14	Norris-Lanc		1866	4-6-0	19x24"	48"	70000
15	Baldwin	1011	9-1861	4-6-0	18x22"	48"	66000
17	Altoona	10	11-1868	4-4-0		D-1	
21	Altoona	35	8-1869	4-4-0		D-3	
23-24	Baldwin	1629&31	5-1867	0-4-0	14x22"	48"	31360
27	Altoona	11	11-1868	4-4-0		D-1	
30	Baldwin	1751	8-1868	4-4-0	14x24"	61"	48160
31	Altoona	9	10-1868	4-4-0		D-1	
34-37	Baldwin	1646-9	7-1867	0-6-0	15x18"	44"	68900
42	Altoona	46	11-1869	0-6-0		B-1	
44	Baldwin	787	10-1857	0-8-0	18x20"	43"	63700
45	Baldwin	789	10-1857	0-8-0	18x20"	43"	63700
3rd 45	Altoona	36	9-1869	4-4-0		D-3	
46	Laird		1867	?-6-?	18x24"	48"	——
48	Altoona	47	12-1869	0-6-0		B-1	
51	Laird		1866	?-6-?	18x24"	48"	——
53	Baldwin	1406	9-1865	4-6-0	18x22"	54"	62720
54	Altoona	7	9-1868	4-4-0		D-1	
56	Altoona	17	4-1869	4-4-0		D-1	
57	Altoona	48	12-1869	0-6-0		B-1	
60	Baldwin	1140	5-1863	4-4-0	17x24"	66"	62720
61	Baldwin	1142	6-1863	4-4-0	17x24"	66"	62720
62	Altoona	12	1-1869	4-6-0		G-1	
63	Baldwin	1284	9-1864	4-6-0	18x22"	54"	62720
64	Baldwin	1407	9-1865	4-6-0	18x22"	54"	62720
65	Altoona	14	3-1869	4-6-0		G-1a	
68	Altoona	49	12-1869	0-6-0		B-1	
71	Laird		1868	?-6-?	18x24"	48"	——
75	Altoona	15	3-1869	4-6-0		G-1a	
79	Altoona	5	8-1868	4-6-0		G-1	
80	Baldwin	1147	6-1863	4-4-0	17x24"	66"	62720
84	Laird		1868	?-6-?	18x24"	48"	——
85	Baldwin	1688	12-1867	4-4-0	16x24"	61"	48160
86	Altoona	50	12-1869	0-6-0		B-1	
87	Altoona	6	8-1868	4-6-0		G-1	

90	Baldwin	1131	5-1863	4-6-0	18x22"	54"	62720
92	Baldwin	1474	3-1866	0-4-0	14x22"	50"	31360
93	Baldwin	1285	9-1864	4-6-0	18x22"	54"	62720
96	Baldwin	1495	6-1866	0-4-0	14x22"	50"	31360
97	Altoona	26	6-1869	4-6-0		G-2	
99	Baldwin	1133	5-1863	4-6-0	18x22"	54"	62720
3rd 99	Altoona	27	6-1869	4-6-0		G-2	
101	Altoona	11a	11-1868	4-4-0	17x24"	60"	——
106	Altoona	28	6-1869	4-4-0		D-3	
107	Baldwin	1286	9-1864	4-6-0	18x22"	54"	62720
108	Baldwin	1409	9-1865	0-6-0	15x18"	44"	48000
109	Baldwin	1315	11-1864	4-6-0	18x22"	54"	62720
110	Baldwin	1197	12-1863	0-6-0	15x18"	44"	44800
111	Baldwin	1199	12-1863	0-6-0	15x18"	44"	44800
112	Baldwin	1413	10-1865	0-6-0	15x18"	44"	48000
115	Baldwin	1317	12-1864	4-6-0	18x22"	54"	62720
116	Baldwin	1448	1-1866	4-6-0	18x22"	54"	62720
123	Altoona	22	5-1869	4-6-0		G-2	
125	Altoona	51	12-1869	0-6-0		B1	
127	Altoona	3	9-1867	4-4-0	17x24"	60"	66000
128-129	Baldwin	793-794	11-1857	0-8-0	18x20"	43"	62700
3rd 129	Altoona	40	11-1869	4-6-0		G-2	
132	Altoona	23	5-1869	4-6-0		G-2	
133	Altoona	8	9-1868	4-4-0		D-1	
136	Altoona	18	4-1869	4-4-0		D-2	
137-138	Baldwin	1304-5	11-1864	4-6-0	18x22"	54"	62720
140	Baldwin	1123	4-1863	0-4-0	11x16"	36"	22400
141-142	Baldwin	1012-3	9-1861	4-6-0	18x22"	48"	66000
3rd 142	Altoona	1	11-1866	4-4-0	16x24"	61"	61100
143	Baldwin	1068	7-1862	0-4-0	11x16"	36"	22400
145	Lancaster		12-1860	4-4-0	18x22"	60"	63000
146	Norris		11-1860	4-6-0	18x22"	48"	71100
147	Altoona	41	11-1869	0-6-0		B-1	
148	Altoona	2	6-1867	4-4-0	17x24"	60"	66000
149	Altoona	19	4-1869	4-4-0		D-2	
152-153	Norris		11-1860	4-6-0	17x24"	49"	68200
154	Baldwin	1744	7-1868	4-6-0	18x22"	55"	79800
155	Altoona	29	6-1869	4-4-0		D-3	
156	Baldwin	847	4-1859	4-4-0	15¼x24"	66"	56000
158	Baldwin	1488	5-1866	0-6-0	15x18"	44"	48000
161	Altoona	21	5-1869	4-6-0		G-1	
168	Altoona	13	1-1869	4-6-0		G-1	
171	Baldwin	1511	8-1866	0-6-0	15x18"	44"	48000
172	Altoona	37	9-1869	4-4-0		D-3	
174	Altoona	30	7-1869	4-4-0		D-3	
179	Altoona	42	11-1869	0-6-0		B-1	
190	Altoona	43	11-1869	0-6-0		B-1	
196	Baldwin	1745	7-1868	4-6-0	18x22"	55"	77200
197	Baldwin	1126	4-1863	0-6-0	15x18"	44"	48000
198	Lancaster		6-1861	4-4-0	18x22"	60"	——
202	Baldwin	1749	8-1868	4-6-0	18x22"	55"	79800
211	Baldwin	1747	8-1868	4-6-0	18x22"	55"	79800

Let us continue the original series and, where possible, the locomotives will be grouped and the replacements indicated at the proper point:

212	Baldwin	1000	2-1861	2-4-0	10x18"	56"	42850
213-214	Baldwin	1003-1004	6-1861	4-6-0	16½x22"	50"	57000
215-216	Baldwin	1006&1008	8-1861	0-6-0	15x18"	44"	44800
2nd 215	Altoona	20	4-1869	4-6-0		G-1	
217	Baldwin	1005	7-1861	0-6-0	15x18"	44"	44800

218	Baldwin	1015	10-1861	4-6-0	18x22″	48″	66000	
2nd 218	Altoona	24	5-1869	4-6-0		G-1		
219-222	Baldwin	1016-1019	11-1861	4-6-0	18x22″	48″	66000	
223	Norris		10-1861	?-6-?	15x24″	49″	——	
224	Baldwin	1014	10-1861	4-6-0	16½x22″	50″	57000	
225	Baldwin	1021	11-1861	4-6-0	18x22″	48″	66000	
226-227	Baldwin	1023&1022	12-1861	4-6-0	18x22″	48″	66000	
228	Baldwin	1025	12-1861	4-6-0	18x22″	48″	66000	
229-230	Baldwin	1027-1028	12-1861	4-6-0	18x22″	48″	66000	
231-232	Baldwin	1029-1030	1-1862	4-6-0	18x22″	48″	66000	
233	Rogers	1009	2-1862	4-6-0	18x22″	48″	——	
234-235	Rogers	1011-1012	3-1862	4-6-0	18x22″	48″	——	
236	Rogers	1013	4-1862	4-6-0	18x22″	48″	——	
237-240	Norris		1862	4-6-0	18x22″	49″	66000	
2nd 238	Altoona	38	10-1869	4-4-0		D-3		
2nd 239	Altoona	4	10-1867	4-4-0	17x24″	60″	66000	
241-242	Baldwin	1032&1034	3-1862	4-6-0	18x22″	48″	62720	
243-244	Baldwin	1036&1039	2-1862	4-6-0	18x22″	48″	62720	
2nd 243	Altoona	31	7-1869	4-4-0		D-2		
245	Baldwin	1013	10-1861	4-6-0	18x22″	48″	66000	—Orig #142
246	Baldwin	1047	3-1862	0-4-0	11x16″	36″	22400	
247	Baldwin	1050	4-1862	0-6-0	15x18″	44″	44800	
248	Baldwin	1055	5-1862	0-6-0	15x18″	44″	44800	
249	Baldwin	1048	3-1863	4-6-0	18x22″	48″	62720	
250	Baldwin	1049	4-1862	4-6-0	18x22″	48″	62720	
251*	Baldwin	1075	8-1862	4-6-0	18½x22″	48″	62720	
2nd 251	Baldwin	1129	4-1863	0-6-0	15x18″	44″	44800	
252	Baldwin	1082	10-1862	0-6-0	15x18″	44″	44800	
253-254	Baldwin	1083&1085	10-1862	4-6-0	18x22″	48″	44800	
255	Baldwin	1084	10-1862	4-6-0	18x22″	48″	44800	
256	Baldwin	1086	11-1862	4-6-0	18x22″	48″	44800	
257-258	Baldwin	1092&1094	11-1862	4-6-0	18x22″	48″	44800	
259	Baldwin	1096	12-1862	4-6-0	18x22″	50″	62720	
260	Baldwin	1098	12-1862	4-6-0	18x22″	50½″	62720	
261	Baldwin	1081	9-1862	4-6-0	16½x24″	66″	62720	
262-265	Baldwin	1099-1102	12-1862	4-6-0	18x22″	50½″	62720	
266-267	Baldwin	1106-1107	1-1863	4-6-0	18x22″	54″	62720	
268-269	Baldwin	1111&1113	2-1863	4-6-0	18x22″	54″	62720	
270	Baldwin	1115	3-1863	4-6-0	18x22″	48″	62720	
271	Baldwin	1119	3-1863	4-6-0	18x22″	54″	62720	
272-277	Norris		1862	4-6-0	18x22″	54″	68040	
278-279	Norris	1067-1068	1863	4-4-0	17x24″	66″	67200	
280	Baldwin	1321	12-1864	4-6-0	18x22″	54″	62720	
281-282	Baldwin	1323&1325	12-1864	4-6-0	18x22″	54″	62720	
283-288	New Jersey L W		1865	4-6-0	18x22″	54″	——	
2nd 287	Altoona	32	8-1869	4-4-0		D-3		
2nd 288	Altoona	33	8-1869	4-4-0		D-3		
289	Baldwin	1326	12-1864	4-6-0	18x22″	54″	62720	
290-292	Baldwin	1306-1308	11-1864	4-6-0	18x22″	54″	62720	
293	Baldwin	1310	11-1864	4-6-0	18x22″	54″	62720	
294	Baldwin	1329	12-1864	4-6-0	18x22″	54″	62720	
295-297	Norris		1863	4-6-0	18x22″	54″	75000	
298-299	Norris		1864	4-6-0	18x22″	54″	75000	
300	Baldwin	1136	5-1863	4-6-0	18x22″	54″	62720	
301-304	Baldwin	1143-1146	6-1863	4-6-0	18x22″	[illegible]	62720	
305	Baldwin	1148	6-1863	4-6-0	18x22″	54″	62720	
306-308	Baldwin	1153-1155	7-1863	4-6-0	18x22″	54″	62720	
309	Baldwin	1163	8-1863	4-6-0	18x22″	54″	62720	
310-311	Baldwin	1167-1169	9-1863	4-6-0	18x22″	54″	62720	

312	Baldwin	1171	9-1863	4-6-0	18x22"	54"	62720
313-314	Baldwin	1207&1209	2-1864	4-6-0	18x22"	54"	62720
315-316	Baldwin	1219&1222	3-1864	4-6-0	18x22"	54"	62720
317	Baldwin	1261	7-1864	4-6-0	18x22"	54"	62720
318	Baldwin	1242	5-1864	4-4-0	17x24"	66"	62720
319-320	Baldwin	1247&1249	6-1864	4-4-0	17x24"	66"	62720
321-322	Baldwin	1259-1260	7-1864	4-4-0	17x24"	66"	62720
323-324	Baldwin	1262-1263	7-1864	4-4-0	17x24"	66"	62720
325	Baldwin	1266	7-1864	4-4-0	17x24"	66"	62720
326	Baldwin	1267	8-1864	4-4-0	17x24"	66"	62720
327	Baldwin	1229	4-1864	0-6-0	15x18"	44"	44800
328-329	Baldwin	1251&1254	6-1864	0-6-0	15x18"	44"	44800
330	Baldwin	1257	7-1864	0-6-0	15x18"	44"	44800
331-332	Baldwin	1344&1346	3-1865	4-4-0	17x24"	66"	60480
333-334	Baldwin	1348-1349	3-1865	4-4-0	17x24"	66"	60480
335-336	Baldwin	1351-1352	3-1865	4-4-0	17x24"	66"	60480
337	Baldwin	1330	1-1865	4-6-0	18x22"	54"	62720
338	Baldwin	1334	2-1865	4-6-0	16x22"	54"	56000
2nd 338	Baldwin	1750	8-1868	4-6-0	18x22"	55"	66080
339-340	Baldwin	1335-1336	2-1865	4-6-0	16x22"	54"	56000
341-342	Baldwin	1338&1341	2-1865	4-6-0	16x22"	54"	56000
343	Baldwin	1342	3-1865	4-6-0	16x22"	54"	56000
344	Baldwin	1355	3-1865	0-6-0	15x18"	44"	44800
345-346	Baldwin	1358&1365	4-1865	0-6-0	15x18"	44"	44800
347-348	Norris		1865	4-4-0	17x24"	66"	67200
2nd 348	Altoona	39	10-1869	4-4-0		D-3	
349-350	Baldwin	1436&1438	12-1865	4-4-0	17x24"	66"	62720
351	Baldwin	1404	8-1865	4-4-0	16x24"	66"	60480
352	Baldwin	1412	10-1865	4-4-0	16x24"	66"	60480
353	Baldwin	1440	12-1865	4-4-0	17x24"	66"	62720
354-355	Baldwin	1450-1451	1-1866	4-6-0	18x22"	54"	62720
356-358	Baldwin	1452-1454	1-1866	4-4-0	16x24"	60"	60480
2nd 358	Baldwin	1521	9-1866	4-4-0	16x24"	60"	60480
359*	Baldwin	1535	10-1866	4-4-0	16x24"	60"	60480
360	Baldwin	1546	11-1866	4-4-0	16x24"	60"	60480
361-362	Baldwin	1440&1432	12-1865	0-6-0	15x18"	44"	44800
2nd 361*	Baldwin	1554	12-1866	4-4-0	16x24"	60"	60480
363-364	Baldwin	1439&1441	12-1865	0-6-0	15x18"	44"	44800
365	Baldwin	1442	12-1865	0-6-0	15x18"	44"	44800
366	Baldwin	1462	2-1866	0-6-0	15x18"	44"	44800
367	Baldwin	1405	8-1865	4-4-0	16x24"	66"	60480
368	Baldwin	1417	10-1865	4-4-0	16x24"	66"	60480
2nd 368	Baldwin	1755	8-1868	4-6-0	18x22"	55"	66080
369	Baldwin	1497	6-1866	4-6-0	18x22"	54"	62760
370	Baldwin	1499	7-1866	4-6-0	18x22"	54"	62760
371-372	Baldwin	1517-1518	9-1866	4-6-0	18x22"	54"	62760
373	Baldwin	1534	10-1866	4-6-0	18x22"	55"	62760
374	Baldwin	1539	11-1866	4-6-0	18x22"	55"	62760
375-378	Baldwin	1542-1545	11-1866	4-6-0	18x22"	55"	62760
379	Baldwin	1548	11-1866	4-6-0	18x22"	55"	62760
380-381	Baldwin	1549-1550	12-1866	4-6-0	18x22"	55"	62760
382-383	Baldwin	1552&1555	12-1866	4-6-0	18x22"	55"	62760
384	Baldwin	1558	12-1866	4-6-0	18x22"	55"	62760
385	Baldwin	1634	5-1867	4-4-0	17x24"	60"	63840
386-392	Baldwin	1635-1641	6-1867	4-4-0	17x24"	60"	63840
393	Baldwin	1645	7-1867	4-4-0	17x24"	60"	63840
394	Baldwin	1659	9-1867	4-4-0	17x24"	60¾"	63480
395	Baldwin	1663	9-1867	4-4-0	17x24"	60¾"	63480
396	Baldwin	1665	10-1867	4-4-0	17x24"	60¾"	63480
397-408	Norris-Lancaster		1867	4-6-0	17x24"	54"	——

409-418	New Jersey L W		1867	4-6-0	18x22"	54"	73000
419	Baldwin	1651	8-1867	4-4-0	17x24"	66"	63840
420-422	Baldwin	1656-1658	8-1867	4-4-0	17x24"	66"	63840
423-424	Baldwin	1766-1767	9-1868	4-6-0	18x22"	55"	66080
425-426	Baldwin	1769&1771	9-1868	4-6-0	18x22"	55"	66080
427-428	Baldwin	1775&1778	10-1868	4-6-0	18x22"	55"	66080
429-430	Baldwin	1780-1781	10-1868	4-6-0	18x22"	55"	66080
431-432	Baldwin	1785-1786	11-1868	4-6-0	18x22"	55"	66080
433-434	Baldwin	1803&1805	12-1868	4-6-0	18x22"	55"	66080
435-436	Baldwin	1795-1796	11-1868	0-6-0	15x18"	44"	47040
437	Baldwin	1807	12-1868	0-6-0	15x18"	44"	47040
438-439	Baldwin	1821-1822	1-1869	0-6-0	15x18"	44"	47040
440	Baldwin	1834	2-1869	0-6-0	15x18"	44"	47040
second							
439-440	Altoona	44-45	11-1869	0-6-0		B-1	
441-442	Baldwin	1901-1902	6-1869	0-6-0	15x18"	44"	47040
443-444	Baldwin	1850-1851	3-1869	4-6-0	18x22"	55"	66080
445-446	Baldwin	1853&1855	3-1869	4-6-0	18x22"	55"	66080
447	Baldwin	1913	6-1869	4-6-0	18x22"	55"	66080
448-450	Baldwin	1917-1919	7-1869	4-6-0	18x22"	55"	66080
451	Baldwin	1922	7-1869	4-6-0	18x22"	55"	66080
452-453	Baldwin	1973-1974	9-1869	4-6-0	18x22"	55"	66080
454-457	Baldwin	1979-1982	10-1869	4-6-0	18x22"	55"	66080
458-459	Baldwin	1985&1990	10-1869	4-6-0	18x22"	55"	66080
460	Baldwin	1992	10-1869	4-6-0	18x22"	55"	66080
461-462	Baldwin	2263-2264	10-1870	4-6-0	18x22"	55"	66080
463-465	Baldwin	2014-2016	11-1869	4-6-0	18x22"	55"	66080
466	Baldwin	2018	11-1869	4-6-0	18x22"	55"	66080
467-470	Baldwin	1929-1932	7-1869	4-6-0	18x22"	55"	66080
471	Baldwin	1941	8-1869	4-6-0	18x22"	55"	66080
472	Baldwin	1928	7-1869	4-6-0	18x22"	55"	66080
473-474	Baldwin	1961&1960	9-1869	4-6-0	18x22"	55"	66080
475-476	Baldwin	1964&1972	9-1869	4-6-0	18x22"	55"	66080
477	Baldwin	2020	11-1869	4-6-0	18x22"	55"	66080
478-479	Baldwin	2050-2051	1-1870	4-6-0	18x22"	55"	66080
480-481	Baldwin	2059&2061	1-1870	4-6-0	18x22"	55"	66080
482	Baldwin	2070	2-1870	4-6-0	18x22"	55"	66080

* #251 was sold to the Northern Central Ry. in 1862. Nos. 359 and 2nd #361 were sold to the Richmond & Danville R. R. in July and August, 1875 respectively

All of the prints used to illustrate this article were taken from the files of this Society but the majority of them originated from the plates owned by the Pennsylvania R. R.

In the above roster, it is possible that there are some omissions of engines that replaced some of the early locomotives during and after the Civil War period—these would not appear in the annual reports of the company. However, the roster has been constructed to the best of our ability and any corrections will be gladly accepted in connection with same.

Pittsburgh, Chartiers & Youghiogheny Railway

By Ivan W. Saunders

The P. C. & Y. was chartered on October 26th, 1881, and was built in 1882 and 1883 from McKees Rocks to Beechmont, Pa., 11.42 miles, with various short branches totaling 4.32 miles. *Poor's Manual* for 1895 shows the company also had trackage rights over the Chartiers R. R., 1.4 miles, giving a gross mileage of 17.14 miles. *Poor's Manual* for 1910 reports an additional 4.82 miles, including trackage rights of 0.87 miles on the P. & L. E., by which connection was made with the Neville Island Branch, all of which is actually on an island in the Ohio River, below Pittsburgh. The connection is made by a bridge over the back channel of the Ohio River, and this single track bridge is the only rail entrance to all trackage on the island, including that of the Pittsburgh & Ohio Valley R. R., one of the only two railroads in the United States located entirely on an island. The P. & L. E. trackage rights connect the two segments of the P. C. & Y., which are not otherwise joined.

Although control of the road has been exercised since the early 1890's by the P. R. R. and the P. & L. E. on an equal basis, the road was for some years included in the Pennsylvania System. Its motive power was lettered in the P. R. R. standard, the use of the initals P. C. & Y. R. W. indicating this, the "R. W." being the abbreviation for "railway" used by the P. R. R. Lines West. As late as the 1930's, some locomotives of the P. R. R. Lines West could been seen at the Pittsburgh 28th Street roundhouse, with P. F. W. & C. R. W. on the backs of their tenders.

Of late years, however, engines were bought second-hand, mostly from the P. & L. E., except for three from other roads, as the accompanying roster shows. The locomotives were and are cared for by the P. & L. E., at McKees Rocks, on the east leg of the big wye, P. C. & Y. power using the turntable of P. & L. E. No. 2 roundhouse. This road has two enginehouses, side by side, although the No. 2 house is now practically dismantled, since the road is rapidly approaching complete Dieselization, already accomplished by the P. C. & Y.

The original engine No. 1 is unknown, but was possibly a second hand "Panhandle" engine (P. C. C. & St. L) of the P. R. R. Lines. Likewise, little is known of No. 9, except that it is said to have been a former P. & L. E. 4-4-0, purchased by the P. C. & Y. some time prior to the first World War, used in passenger service until the early 1920's, and then scrapped. Several P. & L. E. men remember this engine, but do not recall its P. & L. E. number or class.

The P. C. & Y. enjoys an enviable traffic density, as the area it serves is highly industrialized, especially on Neville Island, where are located many of the heavy industries, including the steel companies, the Dravo Corporation, boat builders, fabricators, etc. Connection is made with the P. & L. E., at McKees Rocks, Pa., and with the P. C. C. & St. L. line of the P. R. R., at Beechmont, Pa., about ten miles south-

ward along Chartiers Creek. A mile or so out of the Rocks, on the other side of Chartiers Creek, are the Pennsylvania's Scully Yard and roundhouse. Connection was also made with the Pittsburgh, Allegheny & McKees Rocks R. R., of the Pressed Steel Car Company, until that company abandoned its plant in the Rocks and discontinued its P. A. & McR. R. R.

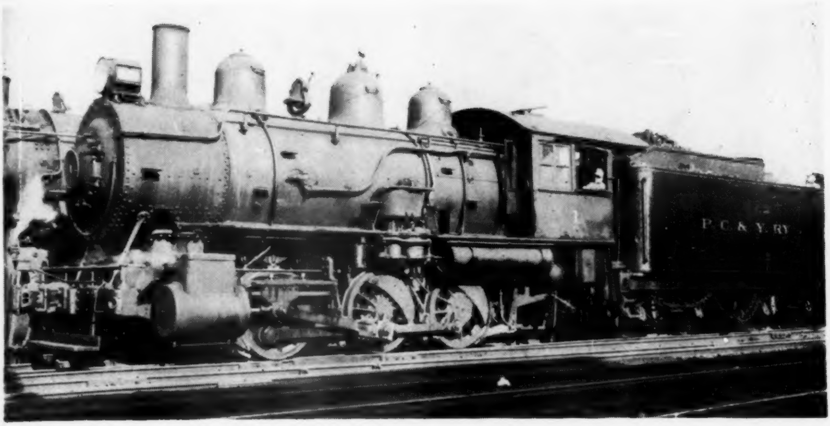
Rolling stock of the P. C. & Y. consisted of a few flats and gondolas, and four cabooses, A to D, and now has only maintenance-of-way equipment, and several flat cars. Since the road has changed to Diesel power, the author has lost interest in it, but would like very much to learn the identity of the two locomotives, first No. 1 and No. 9, in order to complete his records.

Locomotives of the P. C. & Y. Ry.

No.	Builder	C/N	Date	Type	Cyls.	DD	From
1							No data
1	Pittsburgh	2337	1901	0-6-0	19x26	50	
1	P. & L. E.		1909	0-6-0	20x26	51	P&LE 9044, Class B-104.
1	Fairbanks-M.						1000 HP Diesel switcher.
2	Pittsburgh	620	1882	4-4-0	17x24	62	
2	Dickson	28386	1903	0-6-0	19x26	50	
2	P. & L. E.		1912	0-6-0	20x26	51	P&LE 9057, Class B-104.
2	E. M. D.						1000 HP Diesel switcher.
3	Pittsburgh	621	1882	4-4-0	17x24	62	
3	Pittsburgh	1440	1893	4-6-0	19x24	50	
3	Pittsburgh	1936	1899	2-8-0	20x26	50	P&LE 136.
3	Pittsburgh	28383	1903	2-8-0	21x30	51	P&LE 9367, Class G-102-d.
3	P. & L. E.		1912	0-6-0	20x26	51	P&LE 9053, Class B-104.
3	Fairbanks-M.						1000 HP Diesel switcher.
4	Pittsburgh	689	1883	0-6-0	17x24	50	
4	Pittsburgh	2069	1900	2-8-0	20x26	50	P&LE 139.
4	P. & L. E.		1912	0-6-0	20x26	51	P&LE 9061, Class B-104.
5	Pittsburgh	838	1887	4-4-0	17x24	62	
5	Pittsburgh	2121	1900	2-8-0	20x26	50	Sold to Winfield R. R. #1 (?)
6	Baldwin	11520	1891	2-8-0	20x24	50	
6	Pittsburgh	25202	1902	0-6-0	20x26	50	P&LE 9035 (ex-9016)
7	Dickson	26434	1902	0-6-0	19x26	50	
8	Cooke	28387	1903	2-8-0	20x26	50	
9				4-4-0			ex-P&LE ?
10	Pittsburgh	1751	1897	2-8-0	20x26	50	P&LE 121
11	Pittsburgh	1807	1898	2-8-0	20x26	50	P&LE 128
12	Brooks	48823	1911	2-8-0	26x28	62	PRR 9981. Class H-10s
13	Pittsburgh	42869	1907	2-8-0	22½x30	52	PMcK&Y 9423. Class G-102-d.
14	Pittsburgh	27120	1903	2-8-0	22½x30	52	P&LE 9351. Class G-102-d.
15	Baldwin	53629	1920	0-8-0	No data		Newburgh & South Shore #52
16	Pittsburgh	55835	1916	2-8-0	22½x30	51	Monongahela #142

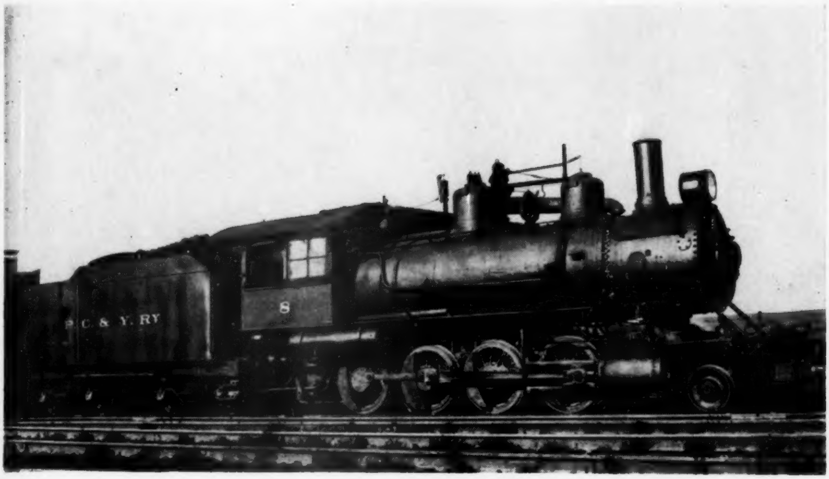
It will be noticed that first No. 3 did not stay long on the road, barely six months, before being replaced. It may have been too light for the service. As it was practically new, it was probably sold. Its successor was also probably sold, being only six years old at the time it was replaced by third No. 3, which was on the road in the early 1930's, and was replaced by fourth No. 3, P. & L. E. 9367, in the mid-1930's.

Information regarding disposition of the steam locomotives is not available, but all have been scrapped except No. 16, which is kept as reserve power.



P. C. & Y. 2nd #1 at McKees Rocks, Pa., 1936. P. & L. E. 1902.

P. C. & Y. 1st #6. Baldwin 1891.



P. C. & Y. #8. Cooke, 1903.

P. C. & Y. #15. Baldwin 1920. Ex Newburgh & South Shore #52.

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The following letter turned up with some old material and was submitted by Mr. Howard F. Greene; received from Mr. John Ayer.

Granted, the spelling and diction leaves much to be desired, but it represents the opinion of one J. Rogers, a farmer of Unity, Maine, relative to the construction of the Penobscot & Kennebec R. R. between Waterville and Bangor, Maine. No one denies the importance of the farmer and his feeding our vast population but, to be of value, the products of the farm must be transported to markets where they can be consumed and that is where the railroad comes in. Well, his opinions are interesting and it seems a pity that he ever married a fisherman's daughter. One can't help but wonder how the boys turned out—perhaps they were successful after all.

GENT,n R. R. FOLKES

Having taken an active part in the exploring of a south RR tract I feel at liberty to make some remarks I shall do this by wrighting.

I find wisdom is not confined to the learned nor doth understanding dwell with the ancients, I will therefore show you my oppinion.

Though my language may not be as concised as the schoular I will try to go ahead like an engoine. In making of RR man must be governed by the laws of nature—rather than of art Still labour-money and art will dig down hills, fill valleys and tunel mountains But Maine with her extensive interiour and exterour, navicable water,—will not warrant such expense Your man has a right to spend his money in throwing sticks against the wind so long as he doth not infringe on the rights of others RR can not be made over hills and threw mountains —or deviate to acomodate every pretty village or individuals like our high ways and by ways Still R Roads opens the different markets to every man—where they pass—for which reason we should give incouragement to all necesry RR

Still I am not for amalgemating the farming and R Road intirest together

Such an union would be fraught with much evile Agraculter is the foundation of life—and the mane thing of every other branch of industrey Commerce & R Roads are but her hand madiens RR can not be built ships can not sale without the assistance of pork & beans Man can live but nine days without eating Look out for the foundation and the building is safe

It belongs to the commertial part of the community to build our RR and they have money enough to do it

If not let them hold there peace

The farmer had better spend his money raising of potatos to fed the Irish whilst diging on RR Still if the farmer spends a little time and money to help exploar and pay an Ingineer to run RR it is money well spent—if for nothing els than teach him the geological and geographical situation of the countrey They would never have been contented till they learnt facts

In so importent an interprise as R Roads much care should be had in its location As before stated RR can not run over hills and threw mountains—but must follow the meandering of valleys—having regard to the local situation of community It is not to be expected that an Ingineere with uncertain guides—will always find the best ground on the first run—one dollar in exploaring will freakently save thousands The object now under consideration is the connecting of Bangor by RR with the RR west

That the Newport route stands preemenint in point of grade to any route as yet found there can be do doubt It must be a strong motive to induse the Company to alter their location to any nearer route as yet found Still I am of the oppinion that our south route may be greatly improved by disinterested cair in the money

Let the road go where it may is all one to me only I should be glad to be gratefied to have it go where I have expleand

I say to the farming intriest again to be ware how they amalgamate with RR incoperations I speak from experience, I was brought up as an agraculteriest—when young I thought to amalgamate the farming and comertial together so I maried a fishermans daughter—but soon found my wife was more fond of catching codfish and taking a gig on on the quarter deck— than of feeding the proudiest Chantileere that ever struted on a dung hill The consequence was our offsprings were half horse and halfaligator If I trusted my boys to drive a team—they where sure to think themselves on boards of fishing smack—under a full sheet of canvass—and would drive on till they had driven my team to daves locker and thrown me on my beam ends So I have lived amidst fish and gurrey with the winds blowing a strong north easter

So it will be with thee my friends if you marry a rail Road incoperation

They will think your team can go by steam your hands can lay by steam your horses can live by steam your potatoes grow by steam and in the end they will caus you to die by steam—and then will burrey you under steam

Let those who are better acquainted with steam manage to suit themselves

If they happen to git scalt in letting off the steam you will have plenty of potatos to make poltices to heal their wounds

Let every man attend his own calling and all is safe

J. Roger

To be read at the RR meeting April 1853 Unity Village and at Dixmont on the 2 inst

In hast Excuse blunders only five minutes for mail

J. Roger

More About the Rhode Island 4-6-2's for the C. M. & St. P.

Strangely enough, controversy over locomotive history is not confined to those of the early years of railroads, whose official records have been lost or forgotten with passing of time. Discussions regarding those of early in the present century, which many of us consider as "in our day," continually arise. In this category are the three engines of the 4-6-2 wheel arrangement, built by Rhode Island for the C. M. & St. P., in 1893, and later purchased by the Plant System from the Rhode Island Works, to which they had been returned by the original purchaser.

Reference to these locomotives in Bulletin No. 88, page 95, brought a letter to the Editor from Mr. H. M. Ghormley, of Oakdale, Tenn., excerpts from which letter are printed herewith, as an interesting post-script to the previous article.

"I worked at Waycross, Ga., for the A. C. L., and the three engines of the old Plant System (S. F. & W.), Nos. 104, 105 and 106, had been renumbered to A. C. L. Nos. 287, 288 and 289. This was in the summer of 1910. At that time, these three engines still had their trailing trucks and 78" drivers, and, if I remember correctly, their cylinders were 20"x26".

"In *Railway and Locomotive Engineering,* October, 1901, Mr. W. E. Symons, S. M. P., states the following, 'I purchased these engines, however, at a time when we were badly pinched for power, and I was compelled to take them in the condition I found them in, except that I had *two* of them changed from compound to simple.'

"Mr. Angus Sinclair wrote 'Engine 105 is one of a lot built by the Rhode Island Works for the C. M. & St. P., but were not accepted because they did not do the work required. It is an odd type of engine, being a big ten-wheeler with a pair of trailing wheels extra placed behind the drivers.'

"I think that the above is enough proof that the trailing wheels were *not* removed by the Rhode Island Works before these engines were re-sold to the Plant System.

"It was after I left Waycross that the trailers were removed and the diameter of drivers reduced, I think it was in 1912. The size of the original compound cylinders was 21" and 31"x26", and not 21" and 36"x26", as stated in Bulletin No. 88. It is perfectly reasonable that the diameter (of the simple cylinders) could have been changed either by bushing or reboring them, changing them from 20" to 19", etc.

"The removal of the trailing truck and the consequent increase in weight on drivers resulted in the unusual ratio of adhesion of 6.55.

"Complete specifications and drawings for these engines can be found in *Modern Locomotives,* 1897 and 1901 volumes."

More About Sir Humphrey Davy

With reference to the account of Sir Humphrey Davy's false claim to priority over George Stephenson in the invention of the mine safety lamp, as described in the Allen Diary, on page 106 of this Bulletin, an interesting item has been brought to the attention of the Editor, which would seem to support the contention that Davy was something of a "claim jumper."

In a letter from William R. Graham, of Houston, Texas, the following comment is made, relative to the doubtful claims of Davy. "There are a few points I would like to clear up about Humphrey Davy, as he has been involved in another case where credit for an invention almost went to the wrong man; to wit, along about the same time that Mr. Stephenson was working on his lamp, a minister in Scotland, with a mechanical turn of mind, invented what was eventually known as the Forsythe lock. This was the fore-runner of the percussion cap mechanism, and revolutionized arms manufacturing almost from the moment it was introduced in 1814. Actually, Forsythe's lock was so efficient that no real improvement was made on it until the invention of the metallic cartridge, about the time of the American Civil War.

"At any rate, Forsythe introduced his invention at a meeting of a philosophical society (I have not been able to find out which one), which was customary before the days of a reliable patent system. Again Mr. (later Sir) Davy wallowed in the aura of assumed glory and, for a while, pushed Forsythe out of the lime-light, on the basis that a man of the cloth had no business being involved in any such infernal invention. Forsythe rebelled at this attitude in true Scots manner and told Davy very explicitly where to go, and that he, Forsythe, would take his invention back to Scotland and set up an arms industry that would run the Sheffields, Endfields and Fallowmaithes out of business.

"To be brief, he did exactly that and Scotland became the seat of the pistol manufacturing in the world, until Sam Colt came up with something better in 1836."

Worth Reading

Compiled by

ELIZABETH O. CULLEN, *Librarian, Bureau of Railway Economics, Association of American Railroads, Washington 6, D. C.*

Books and Pamphlets

Alaska Railroad. Report on Survey and Review of the Operations . . . for the fiscal year ended June 30, 1952, by Stephen B. Ives, General Accounting Office. 39 p. incl. tables. 83rd Cong., 1st Sess., House Document No. 96. Washington 25, D. C., Superintendent of Documents Office. 10 cents.

Application of Electricity to Railways—1952. Bibliography of periodical articles appearing in a select list of periodicals . . . prepared by Edmund Arthur Freeman, assistant librarian, BRE Library. 40 p. Free on request to A.A.R., BRE Library, 1002 Transportation Bldg., Washington 6, D. C. "Part 2. Locomotives, Diesel-electric; Electric; Gas-turbine electric; Steam-turbine electric" pp. 5-13. "Railcars" pp. 15-17. "Radar" and "Radio and Communications" pp. 22-24, 34-35. "Snow and ice melters" p. 28.

A Buckeye Titan—Colonel John Hough James (1800-1881), by William E. and Ophia D. Smith. 558 p. incl. ports, illus. "VI. The Mad River and Lake Erie Rail Road." Cincinnati, Ohio, Historical and Philosophical Society of Ohio. $5.00.

Building Out to Sea—The Key West extension of the Florida East Coast Railway, by Carlton J. Corliss. 13 mimeo. 1. A talk before The Lexington Group at Lexington, Ky., May 7, 1953. "It was my good fortune to have been employed on the Key West Extension . . . for nearly six years—from 1909 to 1914—during the most active period of construction. . . . The construction . . . was in several respects unique in the annals of railway building. In fact, nearly everything about the project was unlike anything ever before undertaken and called for great ingenuity and many improvisations on the part of the engineers . . . "

Central Railway—The Pioneer Line of India. Centenary Commemorative Volume. Designed by J. Walter Thompson Co. (Eastern) Ltd. 40 p. Illus. Printed for Central Railway by Wagle Process Studio & Press, Ltd. Bombay, India. Price not given.

Chittaranjan Locomotive Works, West Bengal, India. Indian Railways Centenary publications. 1) *Chittaranjan—A Periodical* . . . Indian Railways Centenary Issue, *March 1953.* cover-title, xx, 68 p. incl. illus., ports, maps. "The First Railway in India" p. 8. "Locomotive Industry in India" by L. T. Madnani, pp. 17-22. "Six Zones of Indian Railways . . . Route Mileage" p. 26. "The Development of Standard Locomotive Designs To Suit Indian Conditions" by R.H.G. Da Cunha Da Costa, pp. 27-42. "Methods of Improving the Efficiency of Indian Steam Locomotives" by Central Standards Office for Railways, pp. 46-48.

2) . . . *Chittaranjan Locomotive Works—History—Models on Display . . . Indian Railway Pavilion.* cover-title [10] p., incl. illus. For copies of both, apply to General Manager's Office, Chittaranjan Locomotive Works, West Bengal, India.

Directory of Railway Officials & Year Book 1953-1954, compiled from official sources under the direction of The Editor of The Railway Gazette. 130, ii, 530, 131-221 p., incl. tables, charts, illus. London, England, Tothill Press Limited. 40 shillings. 59th year of publication. " . . . All entries continue to be divided into one of two main divisions, namely, British Commonwealth (regardless of Dominion or Colonial Status) and Foreign; each of these sections is again subdivided geographically into continents and countries. Once again it has proved impossible to secure reliable information from most of the 'iron curtain' countries of Eastern Europe. For the first time it has been possible to give extensive details of the personnel and reallocation of lines resulting from the reorganization of the Indian Railways. New entries include those for Cambodia and Viet Nam . . . " p. i.

East African Railways and Harbours TIME TABLE No. 11—Operative from 1st March, 1953, Until Further Notice. cover-title, 62 p. Fold. Map. Illus. Nairobi, Kenya, Africa, Chief Commercial Superintendent, P. O. Box 306. 50 cents. "The Train, Steamer and Road Services Shown Herein Are Subject to Alteration or Cancellation Without Notice." *Index to Stations*—Kenya, Uganda and Tanganyika, pp. iv-vii. "General Information" includes: "Reservation of Accomodation;" "Sleeping Accomodation and Bedding" p. 49; "Catering Charges" p. 50; "Vaccination and Inoculation Certificates" pp. 50-51; "Passengers' Luggage" pp. 51-52; "Currency" [and "Travellers' cheques issued by the undermentioned . . . "] p. 53; "Through Services To and From Egypt and The Sudan via the Nile and Sudan Railways" pp. 54-55, and Timetable Summary F, p. 8.

l'electrification des chemins de fer—S.N.C.F. cover-title, 190 p. incl. illus., maps, charts, diagrs. Paris, France, Science et Industrie. 1350 francs, outside of France and Union Française. "Les locomotives BB série 8100 et CC série 7100," by M. Jouanneau, pp. 27-36. "Locomotives 2D2 de Paris-Lyon" by J. Woimant, pp. 37-41. "Les locomotives électriques à grande vitesse BB 9001 et 9002, BB 9003 et 9004" by M. Lothon, "Les automotrices électriques de la banlieue Sud-Est" by M. Lothon, pp. 48-50. "Notions techniques gènerales sur la traction par courant monophasé 50 Hz" by M. Garreau, pp. 85-90. "Les locomotives prototypes à courant monophasé 20.000 V-50Hz de la S.N.C.F." by L. Devaud, pp. 91-103. "Les prototypes d'automotrices monophasées à 50 Hz de la S.N.C.F." M. Tessier, pp. 104-113. "Les locomotives monophasées 50 Hz de Valenciennes-Thionville" by F. Nouvion, pp. 114-130. "Problèmes soulevés par l'électrification à courant monophasé 50 hertz dans la domaine des installations fixés" by J. Walter, pp. 131-133. Published June, 1953. Published as supplement to "la revue 'Electricité" in June 1953.

Four Whistles to Wood-Up, Stories of the Northern Railway of Canada, by Frank N. Walker. 64 p., Illus. Toronto, Canada, Upper Canada Railway Society, Bulletin No. 37. Price not given. Published for the 100th anniversary of the running of the first steam passenger train in Canada West (Ontario), May 16, 1853.

Great Britain. Transport Act, 1953. 1 & 2 Eliz. 2. Chapter 13. 6 May 1953. ii, 62 p. London, Eng., Her Majesty's Stationery Office. For sale in U.S.A. by British Information Services Sales Office, 30 Rockefeller Plaza, New York 20, N. Y. 45 cents.

Here Comes The School Train! by William H. Bunce. 63 p. Illustrated by author and by photographs of Canadian railways' school trains. New York 10, N. Y., E. P. Dutton, Inc. $2.00.

Hidden Threads of History, Wilson through Roosevelt, by Louis B. Wehle. Some "threads" relating to railroad policy and use of railroads in war in 1917-1918. xix, 300 p. New York, The Macmillian Co. $4.00.

A Historical Sketch of the Baltimore & Ohio Chicago Terminal Railroad Company and Its Predecessor Companies, by G. Murray Campbell. *2nd Edition, Revised March 1953.* Originally presented before Chicago Chapter of this Society on April 11, 1947. 10 proc. 1. Free on request to author, 307 Grand Central Station, Chicago 7, Ill.

The RBA—Its Story. 5 p. Chicago 3, Ill., Railway Business association, 1st Natl. Bank Bldg. Free.

RDC Comes of Age. 24 p. Illus., Diagrs. Philadelphia 15, Pa., The Budd Co. Free. "This is written three years after the first RDCs went to work on the Boston & Albany Division of the New York Central. There were two cars . . . Since then, more than a hundred RDCs have compiled millions of miles of experience. . . . " in United States, Saudi Arabia, Australia, and Cuba.

Railway Development in Maine, by Carlton J. Corliss. 19 proc. 1. Washington 6, D. C., A.A.R. Public Section, Public Relations Dept. Free. Address, June 8, 1953, at Ricker Classical Institute and Ricker College Alumni Association Banquet, Houlton, Maine. "Maine's railway development began in the year 1832, . . . "

Ralph Coffin Richards, 1855-1925—A List of Writings by and about A General Claim Agent of the Chicago & North Western Railway Who Initiated the "Safety First" Movement on Railroads in the United States. October 1, 1953. Compiled by Association of American Railroads. Bureau of Railway Economics Library. 10 proc. 1. Washington 6, D. C., BRE Library. Free.

Report of the Chief Inspector of The Bureau for the Safe Transportation of Explosives and Other Dangerous Articles, Association of American Railroads, March 1953. B. E. Report No. 46, signed by H. A. Campbell, chief inspector, T. C. George, asst. chief inspector, and W. G. McKenna, chief chemist. 27 p. New York 7, N. Y., A.A.R. Bureau of Explosives, 30 Vesey St. Free. " . . . During the year, Inspectors and the headquarters' staff were called on to devote a considerable part of their time to the study of new commodities and problems relating to their transportation. Because of added materials, improvement in

container design, and other changes in conditions 377 amendments to the regulations governing the transportation of explosives and other dangerous articles were submitted to the Interstate Commerce Commission and were approved and published . . . " p. 7.

Royal Journey—A Retrospect of Royal Trains in the British Isles, by C. Hamilton Ellis. 32 p. Illus. London, England, British Transport Commission. 1 shilling.

St. Lawrence Seaway—Hearings before the Subcommittee of the Committee on Foreign Relations, U. S. Senate, 83rd Cong., 1st Sess., on S. 589 and amendments, *S. 1065, and S. J. Res. 45 . . . , April 14, 15, 16; May 20, 21, 1953.* viii, 565 p., Maps, Graphs. Washington 25, D. C., U. S. Govt. Print. Office. "Printed for the use of the Committee . . . "

St. Lawrence Seaway. Report . . . June 16, 1953, by Committee on Foreign Relations, U. S. Senate. iii, 63 p. fold. maps. 83rd Cong., 1st Sess. S. Report No. 441. Free on request to Senate Documents Room, U. S. Capitol, Washington 25, D. C.

Sound Policies in Transportation, by P. Harvey Middleton. 76 p. Chicago 3, Illinois, Railway Business Association, 1st Natl. Bank Bldg. Free. Dated September 1, 1953.

Statens Järnvägar—SJ [Swedish State Railways]. 16 p. Illus. Stockholm, Sweden, Statens Järnvägar. Free. " . . . The object [of this booklet] is to give the visitor from abroad a short description of the aims and scope of Sweden's railways, and particularly of the Swedish State Railways . . . "

Terminologí a ferroviaria americana. I—Trazado. II—Material Rodante. 46 p. Buenos Aires, Argentina, Asociación del Congreso Panamericano de Ferrocarriles, Calle Peru, 277. Distributed at the 8th Pan American Railway Congress, Washington, D. C., 12-25 June 1953. Some copies still available on request to Bureau of Railway Economics Library or Executive Secretary, U. S. National Commission, Pan American Railway Congress Association, Room 1859 Commerce Dept. Bldg., Washington 25, D. C.

Through the Door to Yesterday—Ride One of America's Last, Old-Time Narrow-Gauge Trains! 8p. Illus., Maps. Penn Laird [near Harrisonburg], Virginia, Shenandoah Central Railroad. Free. Maps: "The Shenandoah Central RR"—"built only a few feet from the old survey and grade of the Washington, Cincinnati & St. Louis Narrow Gauge R. R., original predecessor company of the Chesapeake Western Ry." which happens to be located on Dr. Paul S. Hill's farm at Penn Laird. " . . . How to reach Penn Laird, where 'Tweetsie' Is," along with East Broad Top's coach, No. 5, acquired for additional seating capacity, for "The Shenandoah Central is one of three narrow-gauge operating museums in this country, . . . " built to take care of the "transplanted 'Tweetsie'."

Tournatrain—A Rubber Tired Railroad. 3 p. photographs. Longview, Washington (State), R. G. LeTourneau, Inc. Press release dated June 1, 1953. Free.

The Transportation Corps. Military Railway Service [Functions of divisions] 47 l., maps, diagrs. Washington 25, D. C., U. S. Transportation Corps, Department of Defense. Free.

What's Cooking on the B. & O.?—Popular Recipes from B & O Dining Cars [proportioned to family meals] . . . *and Tips about Safety in the Kitchen.* 32 p. Baltimore, 1, Md., Dining Car & Safety Depts., B & O Railroad. Free.

Wheels or Wings, by L. K. Sillcox. 32, vi l. New York 5, N. Y., The Author, c/o The New York Air Brake Co., 230 Park Ave. Free. Presented at Salzberg Transportation Conference, Syracuse University, April 29, 1953. " . . . One must approach the railway passenger problem with a full realization that no one solution is applicable since we have different patterns of passenger movement and each demands individual study. For example, . . . " (pp. 14-19). " . . . There is an enormous amount of work to be done on the service phase of passenger operations . . . The service field is a continuing problem and cannot be cured by orders but only through education of employees . . . In the final analysis, whatever the railways provide in the way of passenger service must be good service or it is a disservice to the public and to themselves. It is needful for public relations since through it the railways have an entree directly to the traveling public and indirectly to the shipping public. . . . " (p. 23-31).

Articles in Periodicals

. . . *Air Freight—New Potentials for Industry,* by John C. Emery. Harvard Business Review, July-Aug. 1953, pp. 82-90, Editorial comments: "Air freight principles applied to rail service." (Railway Age, July 27, 1953, p. 50).

AUTORAILS. La Vie du rail—notre métier, 11 rue de Milan, Paris 9, France, No. 408—Special issue containing history and present developments of rail cars, by countries. Illustrations, part in color, diagrams, some of them showing rail cars from 1847 to present. Price: 100 francs in France; 40 cents in Canada.

Box-car Miles Cut By Direct Route Plan for Empties . . . Railway Age, July 27, 1953, pp. 58-59. "Special Car Order No. 90 of the Car Service Division of the Association of American Railroads may prove, some of its proponents say, as big a boon to the car distributor as C. T. C. has been to the train dispatcher . . . "

The Chicago Great Western Railway, by Frank P. Donovan, Jr. The Palimpsest, State Historical Society of Iowa, Iowa City, Ia., June 1953, pp. 257-288. Illus., Map.

Die Deutsche Verkehrsausstellung München 1953. Die Bundesbahn, July 1953, pp. 553-680. Illus., Maps of the exhibition set-up, Tables, and CXVIII advertising p. carrying out railroad theme of Munich exhibition.

The Electric Train Set F. S., Series FTR 300. Ingegneria Ferroviaria —Revista Dei Transporti, July-August 1953, pp. 515-586. Illus., Diagrs., Graphs. Describes new electric trains of Italian State Railways, brought

into service in April 1953. 8 additional diagrams, folded and inserted in this issue.

Electrification Through The Pennines. I. Operating Conditions Imposed by Temporary Combined Steam and Electric Working . . . 2. Steps Toward All-Electric Working . . . The Railway Gazette, July 31, 1953, pp. 124-128; August 7, pp. 152-154. Map; Gradient profile, Watch-Dunford Bridge section; Illus.

EUROPE Wagon Pool—Common User by Ten European Systems. The Railway Gazette, July 24, 1953, pp. 94-95. "The new agreement was signed on March 2 at Berne, and become effective on March 15. . . . The common user stock retains its original number and inscriptions of the owner railways, and is also marked 'EUROP' . . . " Detailed history and organization for operation and financial arrangements, with poster-type map, in *Die Europäische Güterwagengemeinschaft,* by Dr. Walter Friedrich. (Die Bundesbahn, July 1953, pp. 604-616.

Future of British Transport Commission and Executives—Statement by Minister of Transport [Mr. Alan Lennox-Boyd] in the House of Commons, July 29]: *with the exception of London Transport, Executives not to continue after September 30: Lord Hurcomb to retire.* The Railway Gazette, August 7, 1953, pp. 163-164. Ed. comment: *Abolition,* p. 143; *Lord Hurcomb,* p. 143; *Sir William Wood,* pp. 143-144, with biographical sketches and portraits of Lord Hurcomb and Sir William, p. 159. See also in this list, *Great Britain. Transport Act, 1953* and *New Chairman of the B. T. C. . . .*

Gauge Conversion in South Australia. The Railway Gazette, August 7, 1953, pp. 157-158. Map, Illus.

Grand Opening of the Narrow Gauge Museum, Alamosa, Colorado, July 26, 1953—Visitors Come From Everywhere. Narrow Gauge News, August 1953.

How Radio Helps Record Ore Move on Great Northern Iron Range Lines. Railway Age, September 7, 1953, pp. 100-102, 104. Map, Illus.

Modern Railroader William T. Faricy [President of the Association of American Railroads], by Harry L. Tennant. Modern Railroads, August 1953, pp. 47-50.

New B and O Transportation Museum Opened [July 2, 1953]. Baltimore and Ohio Magazine, July 1953, frontis., inside front cover, and pp. 1, 48. " . . . Reenactment of laying of the first stone [July 4, 1828] a part of opening ceremonies."

New Chairman of the B. T. C.—General Sir Brian Robertson . . . Modern Transport, August 22, 1953, p. 9. Port. Editorial comment, p. 1.

New York Central—100 Years of Steam, by Robert C. Schmid. Railroad Magazine, September 1953, pp. 44-61.

N & W Line and Grade Change Smooths Route in Mountains—Relocation Project . . . Railway Age, September 7, 1953, pp. 81-83. Illus., Plan and profile. " . . . By making channel changes at three locations of Elkhorn Creek [W. Va.], six bridges were eliminated and two were replaced by reinforced concrete-box culverts, one of which provides a triple opening for Elkhorn Creek. . . . "

Old Locomotive Bells Go To Church. Provident Review, Provident Life Insurance Co., July 1953, pp. 8-9. Illus. " . . . The Old Reliable's scrapped steam locomotives have an endearing memorial in the bells which now ring atop over 200 small churches served by the Louisville and Nashville Railroads."

On This New High Line MP Trains Lifted Out of a Street. Railway Age, September 7, 1953, pp. 90-92. Poplar Street, St. Louis, Mo. Six grade crossings eliminated.

On This Santa Fe MTC Reefer . . . Temperatures Stay Below Zero. Initial Trane-Equipped Car, in First Revenue Run from California to East. [Bakersfield, Calif. to Jersey City, N. J.]. Railway Age, September 7, 1953, pp. 93-96.

Only the Railroads Had Enough Capacity for . . . MILK, WATER & BOYS—Several records were set by National Scout Jamboree in California . . . Railway Age, September 7, 1953, pp. 84-89. Illus. " . . . About 50,000 scouts and their leaders attended this year's Jamboree . . . Of these, 27,000 came in 75 special trains which traveled by devious routes so their passengers could tour the West, visiting national parks and localities of scenic or other interest. This 75-train movement is considered one of the greatest single organized non-military movements ever handled in this country . . . Planning for the movement began just about a year in advance. . . " (p. 85). "Vital Statistics" box, p. 89.

Pets Travel Too, by George Fielding Eliot. Town and Country, September 1953, pp. 76-77, 146-147, 149. Illus. State Laws, Laws in Other Countries, Rail, Air and other regulations, that it is essential to observe, when one takes birds, dogs, and other livestock along.

A Prominent Old-Timer in a Reflective Mood Recalls Intimate Days on the C & E I, by Leonard E. Trinkle. The C & E I Flyer, July-August 1953, pp. 3-7. Illus.

Quebec North Shore & Labrador Railroad. 1) . . . by Morris A. Bradley. The Railway Club of Pittsburgh. Official Proceedings, May 21, 1953, pp. 6-10. 2) *A Fast Way to Lay New Track—Developed on the QNS&L* . . . Railway Age, April 6, 1953, pp. 72-74. Illus. 3) *Labrador Ore Cars Are of New Design.* Railway Age, May 25, 1953, p. 20. " . . . first of 1200 . . . 95-ton ore cars . . . "

"Send Us Empties—Now!" by David P. Morgan. Trains and Travel, September 1953, pp. 35-38. Illus. " . . . There's an office down in Washington where the boys sit around with their hands full of empty freight cars. They're playing a game in which a man never figures on losing . . ."—A.A.R. Car Service Division.

This New Swing Span Towed to Site—After Erection on Falsework 368-ft. Structure Was Floated on Barge 80 Miles and Placed in Position on Great Northern Branch with Aid of Tidal Movements. Railway Age, July 27, 1953, pp. 55-57. Illus. Map: Duwamish Waterway, Seattle to Swinomish Slough.

Trucks on the Roads—How Much Should They Pay? Time, August 10, 1953, p. 82. see also *A Tribute to Time Magazine for Courage—But Not for Accuracy. Time,* August 31, 1953, p. 3. An advertisement by American Trucking Associations, and Time's comment, p. 2.

New Books

Buckeye Titan, by W. E. and Ophia D. Smith. 558 pages, 9x6, illustrated. Published by the Historical and Philosophical Society of Ohio, University of Cincinnati Library Building, Cincinnati (21), Ohio, as part of its observance of the Sesquicentennial of the State of Ohio in 1953. Price $5.00.

Colonel John Hough James (1800-1881) was the "Buckeye Titan" and this book is a panorama showing his varied interests and is based on his diaries and correspondence. We see Cincinnati and Louisville when they were busy and important river ports; Lexington, Athens of the West, at the time of Horace Holley and by contrast, such awkwardly growing towns as Columbus, Dayton, Urbana and Indianapolis.

But the part that will interest most of the members of this Society is the part given over to the Mad River & Lake Erie R. R., 55 pages. Col. James was interested in this first railroad in Ohio and his notes have brought forth two interesting facts. The Paterson & Hudson River R. R. was constructed to a 4′10″ gauge. It was anticipated that the projected New York & Erie Ry. would be built to this gauge and, the Mad River & Lake Erie R. R., which was to connect with the New York & Erie, was constructed to this gauge. Well, the New York & Erie decided on a 6′ gauge and that "broke up the party" but this is the reason for the Mad River & Lake Erie adopting the 4′10″ gauge, which later became standard in the State of Ohio.

The other has to do with the locomotive "Sandusky" ordered by this road and the first locomotive built by Rogers, Ketchum and Grosvenor. The common opinion seems to be that Thomas Rogers built the "Sandusky" to show his ability in locomotive construction with the hope of a sale afterwards. This is not so. The records show clearly that Col. James, the President of the railroad, on March 30, 1837, ordered two locomotives to be constructed for a track of 4′10″, to be delivered upon the opening of navigation at Sandusky City in 1839; one locomotive to be named "Sandusky," the second, which was not delivered was to be named "Wyandot."

John H. James was a friend and an admirer of Henry Clay and upon the death of that great man, he was a man without a party—neither Democrat or Republican. During the Civil War he was accused of being a Copperhead. Willing to defend the constitution, he, like many others was unwilling to fight for the abolition of slavery. Lawyer, banker, railroad builder, scientific farmer and stockbreeder, legislator, politician, editor, lecturer and writer, he was the type of man that made our middle-west. In his senior year in college he commenced his diary and this he continued until his death. He was an indefatigable collector of documents, books, manuscripts, etc. and his library contained thousands of carefully selected books on rare Americana. The authors have paid a fine tribute to the "Buckeye Titan" as a part of their sesquicentennial and the book should appeal to many of our members.

Southern Pacific, The Roaring Story of a Fighting Railroad, by Neill C. Wilson and Frank J. Taylor. 256 pages, 9x6, illustrated. Published by McGraw-Hill Book Co., New York, N. Y. Price $4.50.

This, as the title implies, is a history of the Southern Pacific R. R. and I don't suppose that one more history added to those that have gone before will do any great harm. The research worker can only hope that in time these authors may select a railroad whose history has not been so adequately covered.

Conceived by Theodore D. Judah, built by the "Big Four"—Messrs. Huntington, Stanford, Crocker and Hopkins, the railroad pushed its way eastward to connect with the Union Pacific, against tremendous obstacles. In 1869, the railroad had bridged this continent. The activities of this road in Texas and in the Northwest, as well as in politics; the Harriman regime and later day activities are all included between the two covers.

At the close of the book will be found three appendices, one describing the CTC, another furnishing additional material on the motive power and the third on the Snow Sheds. These are followed by "Mileposts" by which more important events are listed in yearly sequence. Commencing with 1836, it continues to 1951.

In the space which has been allotted to these authors, they have succeeded in recounting the history of this vast corporation down through the years in an extremely easy and readable fashion.

The Katy Railroad and the Last Frontier, by V. V. Masterson. 312 pages, 9x6, illustrated. Published by University of Oklahoma Press, Norman, Okla. Price $4.00.

Many Americans seem to feel that with the completion of the Union and Central Pacific Railroads in 1869 that that ended the conquest of the west. The truth is, it was only the beginning. Other transcontinentals followed and the great southwest remained to be developed.

Through the efforts of Judge Levi Parsons, the "Katy" led these southwestern railroads. Stymied but not stopped, this road laid the first rail in what is now Oklahoma on June 6, 1870 but it was only after the Government had given its approval. Continuing to build into Texas it was also forced to build eastward from Kansas into Missouri and in the years that followed the road expanded slowly and steadily. In 1880 the road was leased to the Missouri Pacific under the control of the Gould interests. When this road defaulted on their bond interests, the lease was cancelled and the road operated by its own receivers. Between the turn of the century and 1915, the road was operated by its own officers but the courts took over then and continued to operate the road until 1923 and since this date, the road has had its own management.

The author has endeavored to trace the history of this road from its beginnings to the present. "White man's law did not reach Indian Territory until 1889" and the construction of this road through this territory was far from easy. Denied the coveted land that had been

promised them by our Government, had the builders known this in advance, it is doubtful if the road would have been built at that time.

Despite the obstacles, the railroad went through and it stands as a monument to the courage and tenacity of those pioneers that engineered this enterprise. Histories of our railroads in the southwest are not too common and the history of this road has lost nothing at the hands of the author.

Four Whistles to Wood Up!, by Frank N. Walker. 62 pages, 7⅜x5, illustrated. Published by the Upper Canada Railway Society, Box 122, Terminal A, Toronto, Ontario, Canada. Price 50c.

This interesting little booklet was published in connection with the recent anniversary of the Ontario, Simcoe & Huron Ry. In twelve chapters the author has made a very readable and interesting account of this 94 mile road and he has included many "homey" touches that show his extensive research on this subject. In this country, railroad history should not end at the border—there is too much of a similarity to our own on the other side. The efforts of Messrs. Capreol and Cumberland in connection with this early enterprise have their counterpart in every democratic country. This little publication is well worth owning and it would be nice if our members would encourage the efforts of this Canadian Society by the purchase of a copy of this interesting booklet.

Christmas is not far distant and a good railroad book makes a wonderful present to anyone interested in railroads or railroad history.

Warren Jacobs

It is with sadness and regret that we announce the passing of Warren Jacobs at his home in Hingham, Massachusetts, on October 1st. He was one of the founders of this Society and he was chiefly instrumental in our being invited into the Baker Library of the Harvard Business School. He served on our Board of Directors for nearly thirty years and he was Secretary fifteen of those years. Due to his affliction of blindness, his resignation had to be accepted but the post of Secretary Emeritus was created in recognition of his faithful services.

Altho' born in Brooklyn, N. Y., he came from a New England family and all his railroad work was in New England—Fitchburg; Old Colony; New York, New Haven & Hartford and Boston Terminal Co. No employee was ever more faithful to the interests of his employer and, in 1945, at the age of seventy, he retired. It was his hope that then he could pursue his various historical interests but shortly after his retirement he was stricken with blindness and the last few years were spent in almost total darkness.

No one in this country was better informed about the Old Colony and our railroads in this section. His interests were not confined solely to the motive power but to the actual operation and all that related to it. Turn back to some of our earlier bulletins and note the diversification of his subjects. He was a great student of Abraham Lincoln and our Bulletin No. 33, tracing the two sojourns of that distinguished American to New England is without an equal. His fund of stories and his wide acquaintanceship made him "good company" and these and his knowledge of railroading were not confined to New England.

He loved the old "Bay State," especially the counties of Plymouth, Bristol and Barnstable—home of the Plymouth Rock, the Old Oaken Bucket and the many other things held dear to the average "Yankee." This was his home section and he loved it. Up until the last his mind was active and clear as a bell and he was always ready to "railroad." His interest in and knowledge of our many localities and its people were hard to equal.

For forty years your editor has known Warren and his family. He gave his time and his material into getting this Society off to a good start. The Society never had a more loyal officer or director and any task was undertaken with the "can do" spirit and usually completed before it was expected. He was a grand man to know but a finer one to work with. What Clifford Burr was to railroad history of western Connecticut, Warren was to eastern Massachusetts and in the passing of both of these unusually talented members we have suffered a severe loss for they can never, never be equaled or replaced.

In Memory of

Samuel Kahn
Honorary Member
50 Baywood Avenue,
San Mateo, California
Who Died in September, 1953

Roger I. Lee
Annual Member
510 Groveland Ave., Minneapolis, Minn.,
Who Died on November 15th, 1952

Benjamin Thomas
Annual Member
Crow's Nest, Hesperus Ave.,
Gloucester, Massachusetts
Who Died on June 28, 1953